MICHELIN® X One®
Truck Tire Service Manual

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Introduction

Read this manual carefully — it is important for the SAFE operation and servicing of your tires.

The purpose of this manual is to provide you, the MICHELIN® Truck Tire customer, with some useful information to help you obtain maximized performance and minimized cost per mile. Your MICHELIN® radial tires are a significant investment and should be protected like any other investment. This manual will show you how to do this by increasing your knowledge of tires regarding their selection, performance-affecting vehicle characteristics, maintenance, and tire life extension through repair and retreading. For complete tire specifications, refer to application data books, contact your local MICHELIN Representative, or refer to the MICHELIN website: www.michelintruck.com.

ADDITIONAL REFERENCES

For additional information, consult the following manuals/publications:

MICHELIN® Truck Tire Data Book MWL40731
MICHELIN® Commercial Truck Tire Nail Hole Radial Tire Repair Manual MWT40163
MICHELIN® Crown/Sidewall Repair Template MWT40192
MICHELIN® Truck Tire Limited Warranty and Driver's Manual MWE40021
MICHELIN® X One® Tire Brochure MWL41924
MICHELIN® X One® Driver Information MWL42987

Technical Bulletins: www.michelintruck.com

CDs/DVDs:

MICHELIN® X One® Tire Presentation MWV42737
MICHELIN® X One® Tire Driver Information DVD MWV42991

MICHELIN® tires and tubes are subject to a continuous development program. Michelin North America, Inc. reserves the right to change product specifications at any time without notice or obligation.

Please consult rim manufacturer's load and inflation limits. Never exceed rim manufacturer's limits without permission of component manufacturer.

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Pressure Maintenance

Drivers have commented that an under-inflated MICHELIN® X One® tire is more likely to be detected with a simple visual inspection than dual tires. However, pressure is difficult to gauge visually even for the most experienced driver.

- ▲ **Do** use a properly calibrated gauge when verifying the air pressure of a MICHELIN X One tire.
- ▲ **Don't** rely on the appearance of the tire.
- ▲ **Do** remove and inspect any tire found to be 20% below the recommended air pressure.

Failure to do so may cause tire failure.

Vehicle Handling

Drivers have commented that the wide, stable footprint of the MICHELIN X One tire can provide the feel of a much more stable truck compared to traditional dual tires. However, while most MICHELIN X One tire fitments allow the track of the tractor and trailer to be widened, the vehicle's behavior in curves (on ramps or off ramps) is still subject to roll-over at excessive speeds.

- ▲ **Don't** let the outstanding handling of MICHELIN X One tires give you a false sense of stability in curves.
- ▲ **Do** respect all posted speed limits regardless of tire fitment.

Failure to do so may cause vehicle to tip.

Rapid Air Loss Techniques

Extensive testing has shown that a rapid air loss on a MICHELIN X One tire will not compromise the stability and behavior of the vehicle. However, with one tire on each axle end, the loss of air pressure will allow the wheel and axle end to drop and possibly contact the road surface.

- ▲ **Don't** try to "limp home" or continue to run on a flat tire.
- ▲ **Do** down shift or use the trailer brake (when appropriate) to avoid tire/wheel assembly lock-up.
- ▲ **Do** release the brakes intermittently as you slow down to allow some rotation of the assembly.

Failure to do so may cause irreparable damage to the tire, wheel, axle components, and vehicle.

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Tire and Wheel Nomenclature

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SELECTING A TIRE

EQUIVALENT MICHELIN® X ONE® SIZES

When retrofitting MICHELIN® X One® tires of equivalent size, changing engine computer revolutions per minute (RPM) should be all that is required.

Consult your equipment manufacturer and Michelin representative for details if you are retrofitting other than equivalent sizes.

TIRE REVOLUTIONS PER MILE AND RETROFITS TO MICHELIN® X ONE® TIRES

Gear Ratio: A change in tire dimension will result in a change in engine RPM at a set cruise speed* that will result in a change in speed and fuel economy. The effect of tire size change on gear ratio should be considered in individual operations.

A decrease in tire radius will increase tractive torque and increase indicated speed. An increase in tire radius will reduce tractive torque and decrease indicated speed.

Tire Revs./Mile – Speed – Size: These factors can affect engine RPM if corresponding changes are not made to engine ratios.

Example: Going from larger diameter tire to smaller diameter tire.

If you currently run a 275/80R22.5 MICHELIN XDN®2 tire (511 Tire Revs./Mile) and change to a 445/50R22.5 MICHELIN X One® XDN®2 tire (515 Tire Revs./Mile), the speedometer will indicate a slightly higher speed than the actual speed the vehicle is traveling.

$$\frac{\text{Final Tire Revs./Mile} - \text{Initial Tire Revs./Mile}}{\text{Initial Tire Revs./Mile}} =$$

$$\frac{515 - 511}{511} = 0.0078 \text{ or } .78\% \ (< 1\% \text{ change})$$

So when your actual speed is 60 mph, your speedometer will read 60.47 mph.

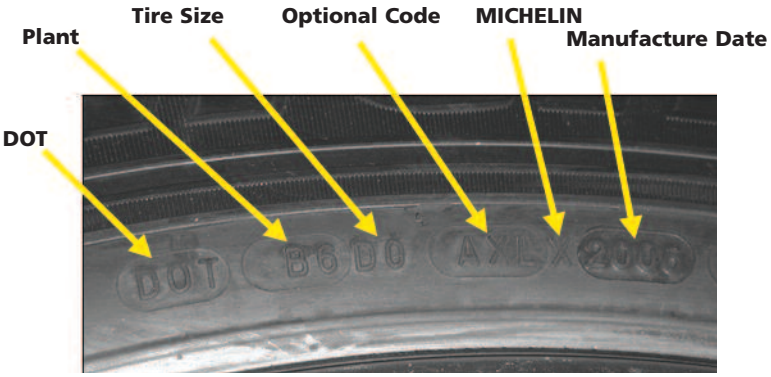
MICHELIN® X One® Tire Size	MICHELIN® X One® Tire Revs./Mile	Dual Size	Dual Tire Revs./Mile
445/50R22.5	515 (X One XDN2)	275/80R22.5	511 (XDN2)
455/55R22.5	492 (X One XDN2)	11R22.5 or 275/80R24.5	495 (XDN2)

DOT SIDEWALL MARKINGS

All new tires sold in the United States must have a DOT (Department of Transportation) number cured into the lower sidewall. All retreaded tires must also have an additional DOT branded into the sidewall. It is recommended that the retread DOT be placed in the lower sidewall near the original DOT code. Certain states may require labeling in addition to the Federal requirements certifying compliance with the Industry Standard for Retreading. Tires manufactured prior to the year 2000 end with 3 digits rather than 4, the first two numbers indicating the week and the last one indicating the year of production, followed by a solid triangle to indicate the decade of 1990s. Tires made or retreaded after the year 1999 will end with a four-digit code: the first two indicate the week, and the last two indicate the year of manufacture.

Example: DOT B6 D0 AXL X 2006

New tire markings required by the Department of Transportation:



TIRE MARKINGS/LOAD RANGES/ISO/DOT DESCRIPTIONS

Size	Design	LI/Ply Rating	ISO Load	ISO Speed	Approximate Weight**
445/50R22.5	X One® XDA®	L/20	161 (10,200 lbs)	L (75 mph)	177
	X One® XDN®2	L/20	161 (10,200 lbs)	L (75 mph)	182
	X One® XRV®	L/20	161 (10,200 lbs)	L (75 mph)	164
	X One® XTE®	L/20	161 (10,200 lbs)	L (75 mph)	164
	X One® XTA®	L/20	161 (10,200 lbs)	L (75 mph)	161
455/55R22.5	X One® XDN®2	L/20	164 (11,000 lbs)	L (75 mph)	201
	X One XTE★	L/20	164 (11,000 lbs)	L (75 mph)	182
	X One® XZU® S	M/22	166 (11,700 lbs)	M (75 mph)	198
	X One® XZY®3	M/22	166 (11,700 lbs)	M (75 mph)	202

★ Indicates a cut and chip resistance tread compound for more aggressive environments.
* Exceeding the legal speed limit is neither recommended nor endorsed.
** The weights are estimates only. The actual weight may vary.

TIRE APPLICATIONS AND DESIGN

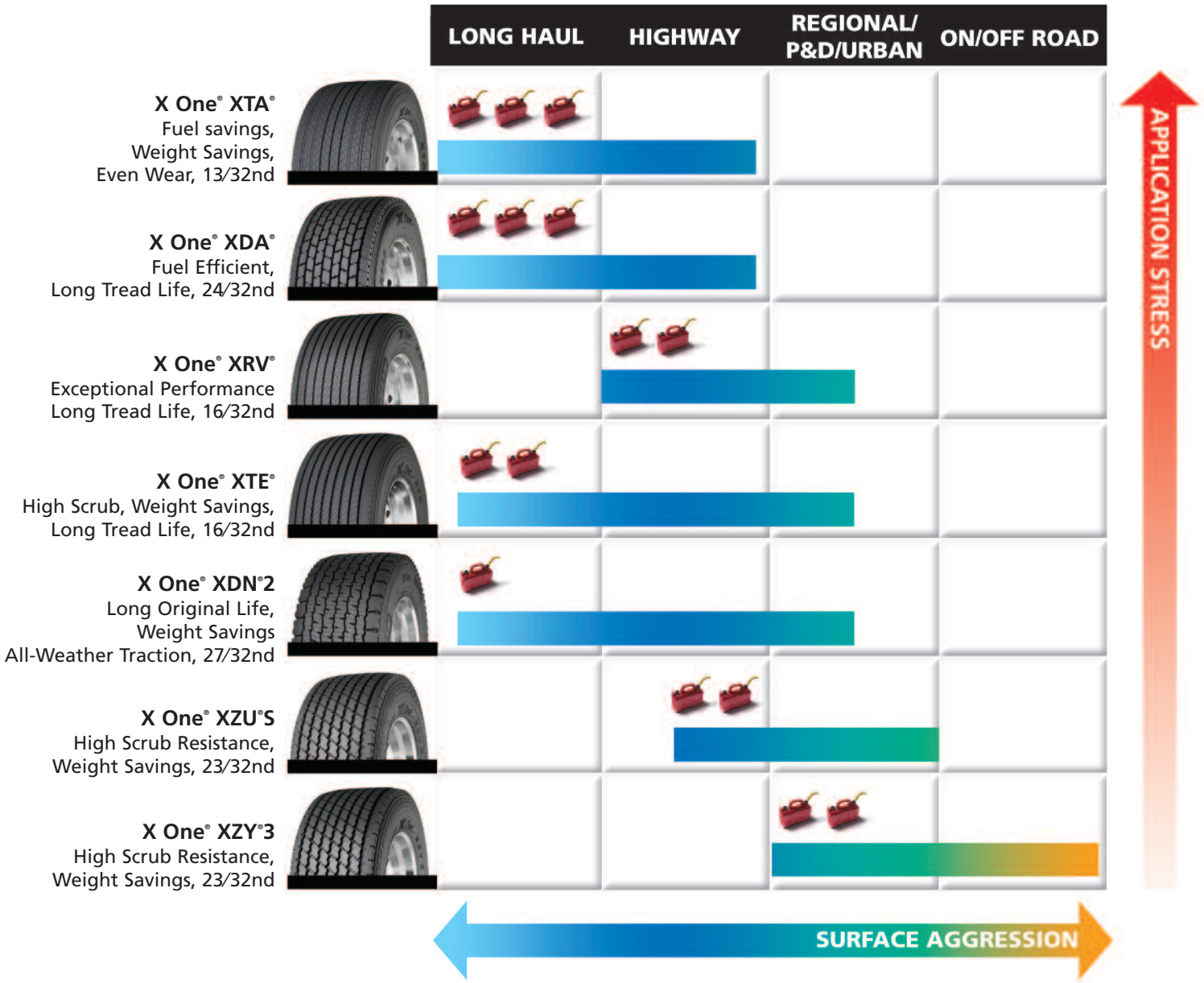
Long Haul (A): The Long Haul application is composed of businesses operating primarily in common carrier vocations.
Vehicle annual mileage – 80,000 to 200,000.

Regional (E): The Regional application is made up of businesses such as public utilities; government – federal, state, and local; food distribution/process; manufacturing/process; petroleum; and schools operating within a 300-mile radius.
Vehicle annual mileage – 30,000 to 80,000.

On/Off Road (Y): On/Off Road tires are designed to provide the durability and performance necessary in highly aggressive operating conditions at limited speeds. Vocations such as construction, mining, and logging use these highly specialized tires.
Vehicle annual mileage – 10,000 to 70,000.

Urban (U): Urban applications are very short mileage with a high percentage of stop and go. Primarily users are in retail/wholesale delivery, bus fleets, and sanitation.
Vehicle annual mileage – 20,000 to 60,000.

Want to know how much money you can save by switching to MICHELIN tires?
Use our Weight Savings or Fuel Savings calculator to find out. Go to www.michelintruck/com/toolbox.


LONG HAUL
HIGHWAY
REGIONAL/ P&D/URBAN
ON/OFF ROAD
X One® XTA®
Fuel savings, Weight Savings, Even Wear, 13/32nd
X One® XDA®
Fuel Efficient, Long Tread Life, 24/32nd
X One® XRV®
Exceptional Performance Long Tread Life, 16/32nd
X One® XTE®
High Scrub, Weight Savings, Long Tread Life, 16/32nd
X One® XDN®2
Long Original Life, Weight Savings All-Weather Traction, 27/32nd
X One® XZU®S
High Scrub Resistance, Weight Savings, 23/32nd
X One® XZY®3
High Scrub Resistance, Weight Savings, 23/32nd
APPLICATION STRESS
SURFACE AGGRESSION

SELECTING A WHEEL

OUTSET/INSET

Outset: The lateral distance from the wheel centerline to the mounting surface of the disc. *Outset* places the wheel centerline outboard of the mounting (hub face) surface.
Inset: The *Inset* places the wheel centerline inboard of the mounting (hub face) surface or over the axle.

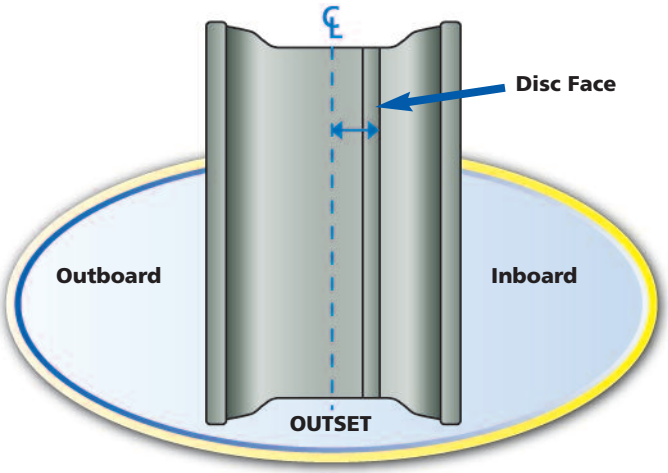
USE OF 2" OUTSET WHEELS WITH MICHELIN® X ONE® TIRES

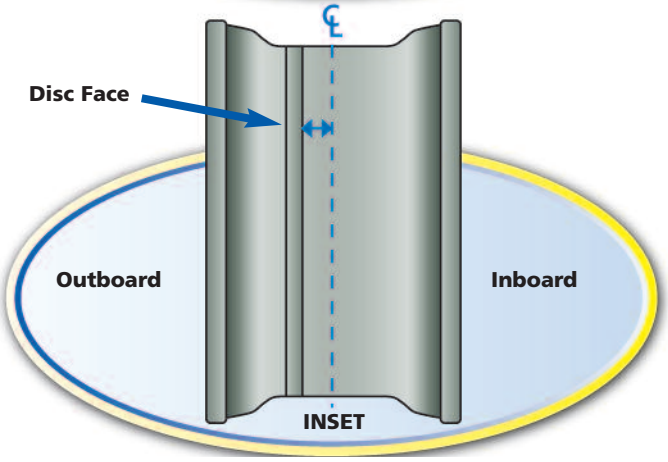
The MICHELIN® X One® tires (445/50R22.5 and 455/55R22.5) require the use of 14.00 x 22.5" wheels. The majority of the wheels currently offered have a 2" outset.

Some axle and hub manufacturers have recently clarified and confirmed their position concerning the use of such wheels with their respective components. While the position of the component manufacturers is not totally consistent, the majority view concerning the retrofit of duals with MICHELIN® X One® tires can be summarized as follows:

Axle Type*	Spindle Type	Wheel Recommendation
Drive axles	"R"	2" outset wheels
Trailer axles	"P"	2" outset wheels
Trailer axles	"N"	Check with component manufacturer

* Many other axle and spindle combinations exist. Contact axle manufacturer.





Truck and trailer manufacturers may have different specifications. For optimum track width, stability, and payload, end-users should talk to their trailer suppliers about the use of 83.5" axles with zero outset wheels.

End-users that have retrofitted vehicles with 2" outset wheels should contact their respective vehicle, axle, or component manufacturers for specific application approvals or maintenance recommendations.

NOTE: Use of outset wheels may change Gross Axle Weight Rating (GAWR). Consult vehicle and component manufacturer.

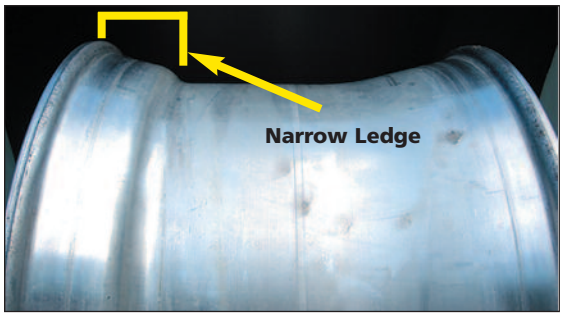
DROP CENTERS

The Drop Center is the well or center portion of the wheel. This is what allows the tire to be easily mounted on a single piece wheel: the tire bead will "drop" into this cavity.

The 14.00 x 22.50" (15-degree bead seat) drop center tubeless wheel required for the MICHELIN® X One® tire has differently styled drop centers depending on the manufacturer.

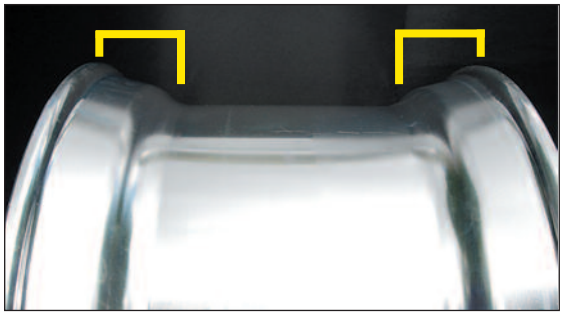
Accuride® aluminum (part #29660) and steel wheels as well as Hayes Lemmerz® steel wheels are produced with a narrow ledge on one side and a long tapered ledge on the other. The narrow ledge is necessary to ease the mounting and dismounting process.

The Alcoa aluminum wheel is manufactured with a narrow ledge on either side. This allows it to be mounted and dismounted from either side.



Accuride

WARNING Always ensure the narrow ledge is up when mounting or demounting.



Alcoa

VALVE SYSTEMS

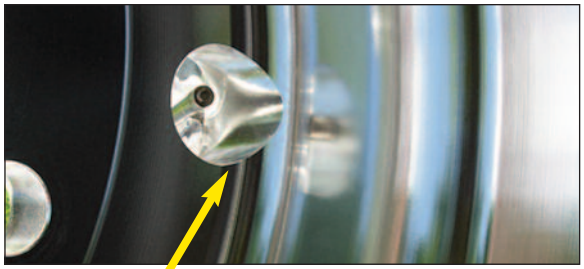
Always replace the whole valve assembly when a new tire is mounted.

Ensure the valve stem is installed using the proper torque value: 80 to 125 in/lbs (7 to 11 ft/lbs) for aluminum wheels and 35 to 55 in/lbs (3 to 5 ft/lbs) for tubeless steel wheels.

When an aluminum wheel is used in the outset position, a TR543E or TR553E valve degree bend can be used. This valve has a 75-degree bend that facilitates taking air pressures. If the valve stem is installed on the inboard side of the wheel, ensure proper clearance exists between the brake drum and the valve stem. It is highly recommended that the older style valve stems be replaced with the newer style TR553E to minimize corrosion build-up, thereby minimizing stem leaks.

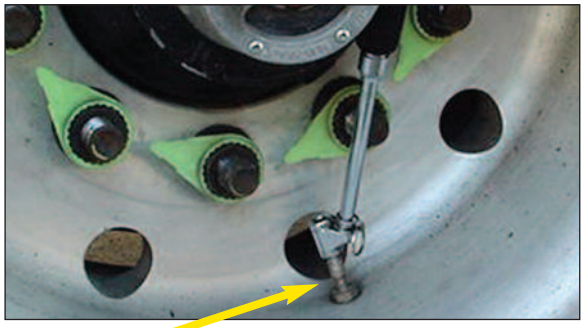
TR5533E Valve (left) and TR543E (right)

When installed in the inset position, the longer TR545E valve is required.



TR545E Valve

If the operator uses the wheel as a step when securing the load, a straight TR542 valve may be preferable. An angle head pressure gauge will be required to check air pressure, but it may still be difficult due to interference with the hub.



TR542 Valve

Per *TMC RP 234, Proper Valve Hardware Selection Guidelines* it is recommended that an anti-corrosive or dielectric compound be used on the valve stem threads and O-rings prior to installation. This will prevent corrosion from growing around the O-ring, which squeezes it and causes leaks. Check with your aluminum wheel manufacturer or valve stem supplier for their recommendation of an anti-corrosive compound.

Corrosion Related Leak

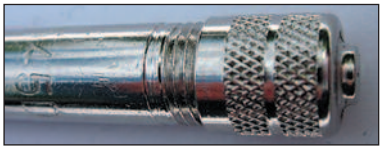
Note Corrosion On Bottom Valve

Checking for loose and leaky valve stems should be made a part of your regular maintenance schedule. Methods for checking for loose valve stems are:

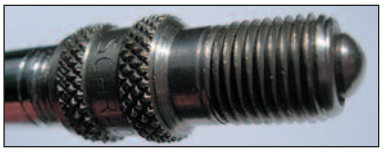
– check with a torque wrench,
– check by hand to see if the valve nut is loose,
– spray a soapy solution on the valve to see if there is a leak.

To protect the valve from dirt and moisture, a heat resistant metal valve cap with a rubber seal must be installed. The number one cause of air loss in tires can be attributed to missing valve caps.

To facilitate air pressure maintenance, a dual seal metal flow through cap may be used instead of a valve cap. These should be installed hand tight only to prevent damaging the seal (1.5 - 3 in/lbs).



Valve Cap With Rubber Seal



Dual Seal Metal Flow-Through Cap

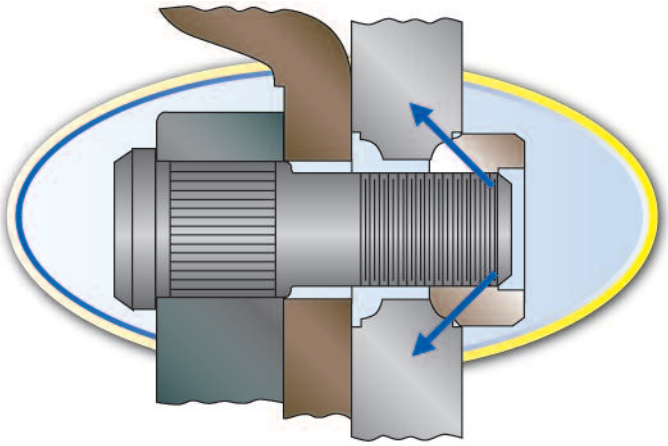
WHEEL SYSTEMS

STEEL VS ALUMINUM

Depending on the vehicle's vocation, a customer may choose steel wheels over aluminum. However, a 14.00 x 22.5" aluminum wheel is up to 68 lbs. lighter than its steel counterpart. Due to the larger drop center of the aluminum wheel, it is typically easier to mount the MICHELIN® X One® tire on aluminum wheels.

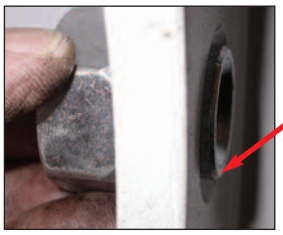
STUD PILOTED WHEELS

There are aluminum and steel wheels with 2" outset currently available in stud piloted configuration. Stud piloted disc wheels are designed to be centered by the nuts on the studs. The seating action of ball seat nuts in the ball seat holes centers the wheel. Fasteners with left hand threads are used on the left side of the vehicle and those with right threads are used on the right side of the vehicle.



SPECIAL FASTENERS

It is necessary to order "cap nuts" to replace the inner and outer nuts that are used when mounting a traditional stud piloted dual assembly. These parts can be ordered from a wheel distributor in your area. The part numbers are listed on Page 8. A 50/50 split of left and right hand threads will be required.



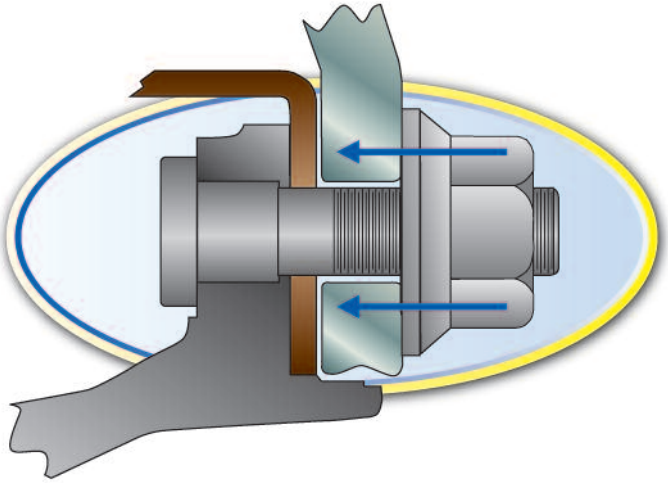
WARNING

CAUTION: Do not use the 5995 nut on steel stud piloted wheels, as the shoulder will protrude past the disc face.

From left to right: Aluminum MICHELIN® X One® tire fastener, steel or aluminum MICHELIN® X One® tire fastener, and steel MICHELIN® X One® tire fastener. See application chart on Page 8 for part numbers and more information.

HUB PILOTED WHEELS

Both aluminum and steel wheels are currently available in hub piloted configuration. Hub piloted disc wheels are designed to center on the hub at the center hole or bore of the wheel. The wheel center hole locates the wheel on pilots built into the hub. Hub piloted wheels use the same 2-piece flange nut as duals that contact the disc face around the bolt hole. Only one nut on each stud is used. Hub piloted wheels have straight bolt holes with no ball seat.



WARNING Correct components must be used.

It is important to note that some hub piloted and stud piloted wheels may have the same bolt circle pattern. Therefore, they could mistakenly be interchanged. Each mounting system requires the correct mating parts. It is important that the proper components are used for each type of mounting and that the wheel is fitted to the proper hub.

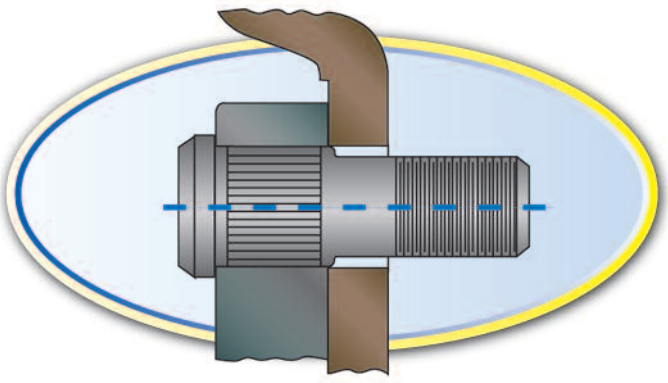
If hub piloted wheel components (hubs, wheels, and fasteners) are mixed with stud piloted wheel components, loss of torque, broken studs, cracked wheels, and possible wheel loss can occur, which can lead to injury or death. These parts are not designed to be interchangeable. Refer to *TMC RP 217B, Attaching Hardware for Disc Wheels*, and *TMC RP 608A, Brake Drums and Rotors*.

NOTE: Some states and provinces have laws that dictate sufficient thread engagement or thread engagement past the nut body. Make sure you know the laws for the states and provinces in which you operate and comply.

TORQUE

Stud piloted, ball seat mounting system:

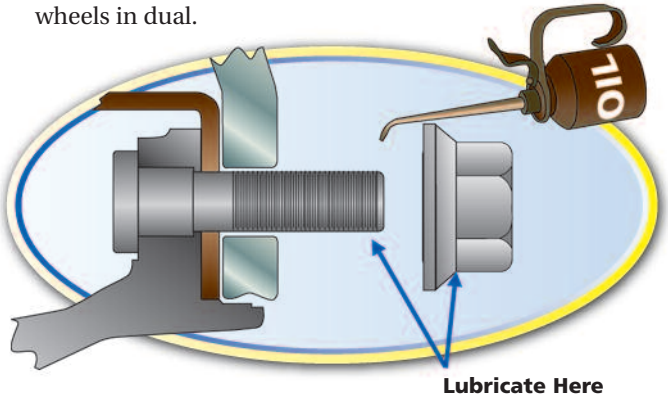
Left hand threads are used on the left side of the vehicle. Right hand threads are used on the right side of the vehicle. Tighten the nuts to 50 foot-pounds using the sequence shown. Check that the wheel is properly positioned, then tighten to recommended torque using the sequence shown. It is recommended that studs and nuts on a stud piloted mounting system should be free of rust and debris. They should then be torqued “dry” to 450-500 foot-pounds. After 50 to 100 miles of operation, torque should be rechecked.



Hub piloted mounting system:

Most North American manufacturers of highway trucks, tractors and trailers, which incorporate the hub piloted wheel mounting system, require wheel studs and 2-piece flange nuts with metric threads. Most frequently these are M22 x 1.5. Before installing 2-piece flange nuts apply 2 drops of SAE (Society of Automotive Engineers) 30W oil to the last 2 or 3 threads at the end of each stud and 2 drops to a point between the nuts and flanges. This will help ensure that the proper clamping force is achieved when final torque is reached. Lubrication is not necessary with new hardware. To aid in installation and removal of aluminum wheels, some wheel manufacturers recommend lubricating the hub bore and/or pilot pads. Check with your wheel manufacturer for additional direction.

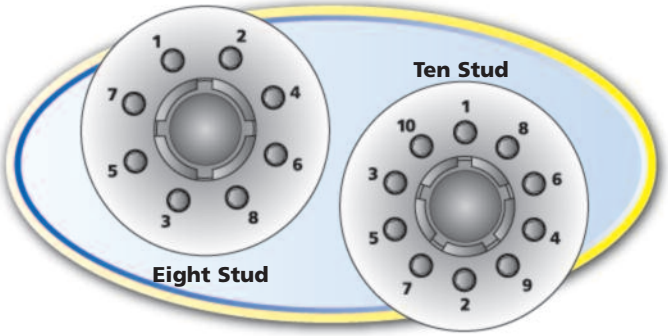
Note: When retrofitting a dual equipped tractor with steel wheels to an aluminum wheel with MICHELIN X One tire, it may be necessary to install longer studs to obtain proper thread engagement of the nut. This is due to the aluminum wheel’s disc face being approximately 1⁄4" thicker than two steel wheels in dual.



Lubricate Here

Torque Sequence:

Both stud piloted and hub piloted wheel systems use the same torque sequence. Tighten the flange nuts to 50 foot-pounds using the sequence shown. Check the disc wheel for positioning on the pilots and proper seating against the drum face. Tighten to 450 to 500 foot-pounds using sequence shown. After 50 to 100 miles of operation, torque should be rechecked.



PROPER FASTENERS FOR MICHELIN® X ONE® TIRES ON STUD PILOTED WHEELS

It is important that the proper fasteners be used when mounting the MICHELIN® X One® tire on stud piloted wheels. If a fastener specified for the stud piloted aluminum wheel is used on a steel wheel, it will bottom out on the brake drum, and the proper clamping force necessary to help ensure that the torque on the wheel remains constant will not be achieved, possibly resulting in a "wheel off" situation.

In the table below, the top fastener, Part No. 5554R&L is primarily for the Alcoa single mounted stud piloted aluminum wheel (example: 8.25 x 22.5") and 14.00 x 22.5" wide base stud piloted steel wheel. Part No. 5995R&L is for the Alcoa 14.00 x 22.5" wide base stud piloted aluminum wheel.

The last two fasteners Part No. 5652R&L for a 3⁄4"–16 studs and 5977R&L for a 1-1⁄8"–16 studs are specified for the 14.00 x 22.5" stud piloted steel wheel.

	Part No.	Replaces	Thread	Hex	High	Application and General Information
	5554R&L	Alcoa 5554R&L Budd 706 13/4	3⁄4" – 16	1 1⁄2"	1"	For Single Mounting of Alcoa Forged Aluminum Disc Wheels and Steel Stud Piloted Wide Single Wheels.
	5995R&L	Alcoa 5995R&L Webb 178950R 178951L	3⁄4" – 16	1 1⁄2"	1 3⁄8"	For Alcoa Wide Base Aluminum Wheels – "Long Grip" Cap Nut Larger height provides greater lug wrench contact with the wheel.
	5652R&L Zinc Dichromate Plating	Accuride NTL/NTR 25 Budd 37888/9 Gunite 2564/65 Motor Wheel 84523/24	3⁄4" – 16	1 1⁄2"	7⁄8"	Steel Wheel: Single Stud Mounting Front and Rear
	5977R&L Hardened Zinc Yellow Dichromate Plating	Alcoa 5977 R&L Accuride NTL/NTR 25 Alcoa 5552R&L Budd 37891/2	1 1⁄8" – 16	1 1⁄2"	7⁄8"	Single Large Stud Mounting Front and Rear

NOTE: The table provided is for reference only. Wheel specific questions should be directed to the wheel manufacturer.

WHEEL SPECIFICATIONS

14.00 x 22.5" – 15-DEGREE DROP CENTER WHEEL SPECIFICATIONS

Manufacturer	Material	Part No.	Finish	Weight (lbs.)	Outset	Inset	Max Load & Inflation
10-hole, stud located, ball seat mounting – 11.25 in. bolt hole circle							
Alcoa	Aluminum	841100	Machined	71	2.0	0.87	12800 @ 125
Alcoa	Aluminum	841102	Polished	71	2.0	0.87	12800 @ 125
Hayes Lemmerz	Steel	10070TW	White	125	2.00	1.49	11000 @ 125
8-hole, hub piloted mounting – 10.827 in. bolt hole circle							
Alcoa	Aluminum	841400	Brushed	71	2.0	.87	12800@125
Alcoa	Aluminum	841402	Polished	71	2.0	.87	12800@125
10 Hole, 2" outset, hub piloted mounting – 285.75 mm bolt hole circle							
Alcoa	Aluminum	841600	Machine Finished	71	2.0	.87	12800@125
Alcoa	Aluminum	841600DB	Machine Finished Dura-Bright®	71	2.0	.87	12800@125
Alcoa	Aluminum	841602	Polished Outside	71	2.0	.87	12800@125
Alcoa	Aluminum	841602DB	Polished Outside Dura-Bright®	71	2.0	.87	12800@125
Accuride	Aluminum	29660ANP	Machined	70	2.0	.88	12800@130
Accuride	Aluminum	29660OAP	Polished	70	2.0	.88	12800@130
Accuride	Steel	29890	White	132	2.0	1.38	12800@120
Hayes Lemmerz	Steel	10027TW	White	136	2.0	1.49	11000@125
10 Hole, 0" outset, hub piloted mounting – 285.75 mm bolt hole circle							
Alcoa*	Aluminum	841610	Machine Finished	71	0	-1.13	12800@125
Alcoa*	Aluminum	841610DB	Machine Finished Dura-Bright®	71	0	-1.13	12800@125
Alcoa*	Aluminum	841612	Polished	71	0	-1.13	12800@125
Alcoa*	Aluminum	841612DB	Polished Dura-Bright®	71	0	-1.13	12800@125
Accuride*	Aluminum	40016ANP	Polished	70	0.56	0.56	12800@130
Accuride*	Aluminum	40016OAP	Polished	70	0.56	0.56	12800@130
Accuride*	Steel	29891	White	132	0	0.63	12800@120
Hayes Lemmerz	Steel	10027TW	White	136	0.51	0	12300@120
10 Hole, 1.13" outset, hub piloted mounting – 285.75 mm bolt hole circle							
Alcoa	Aluminum	841611	Polished Outside	71	1.13	0	12800@125
Alcoa	Aluminum	841611DB	Polished Outside Dura-Bright®	71	1.13	0	12800@125
Alcoa	Aluminum	841619	Machine Finished	71	1.13	0	12800@125
Alcoa	Aluminum	841619DB	Machine Finished Dura-Bright®	71	1.13	0	12800@125

NOTE: The table provided is for reference only. Wheel specific questions should be directed to the wheel manufacturer.
***0" Outset Aluminum Wheels:** Alcoa uses the mounting face as the reference.
Accuride uses the center line as the reference. This means that an Accuride 0" outset wheel is listed as 0.56" outset wheel.
Alcoa at www.alcoawheels.com; Dura-Bright® is a registered trademark of Alcoa
Accuride at www.accuridecorp.com
Hayes Lemmerz at www.hayes-lemmerz.com

SPECIAL PROVISION FOR STEER AXLE USE ON 13.00 x 22.5" WHEELS

455/55R22.5 load range 'M' may be fitted with 13.00 x 22.5" wheels for first life use on the steer axles. The reduced loads shown in the following table must be observed.

Technical specifications for MICHELIN 455/55R22.5 LRM with 13.00 x 22.5" wheels steer axle, first life only.

Dimension	Load Range	Loaded Radius		RPM	Max. Load Single			
		in.	mm.		lbs.	psi	kg.	kPa
455/55R22.5	LRM	19.5	496	493	10000	120	4535	830

Dimension	Load Range	psi	75	80	85	90	95	100	105	110	115	120
		kPa	520	550	590	620	660	690	720	760	790	830
455/55R22.5	LRM	lbs. per axle	13740	14460	15180	15880	16600	17280	17980	18660	19340	20000
		kg. per axle	6240	6520	6900	7180	7560	7820	8100	8460	8720	9070

To determine the proper load/inflation table, always refer to the markings on the tire sidewall for maximum load at cold pressure.
Contact your MICHELIN dealer for tires with maximum loads and pressures other than indicated here.

Load and inflation industry standards are in a constant state of change. Michelin continually updates its product information to reflect these changes. Therefore, printed material may not reflect the current load and inflation information.

NOTE: Never exceed the wheel manufacturer's maximum air pressure limitation.
In order to be under Federal maximum width of 102", an inset wheel must be used. A 4.32" inset will net 101.5" overall width on some refuse vehicles. There are currently steel wheels available from Accuride and Hayes Lemmerz. Caution: Ensure the wheel does not interfere with vehicle components when making full turns.

13.00 x 22.5" – 15-DEGREE WHEEL SPECIFICATIONS

Manufacturer	Material	Part No.	Finish	Weight (lbs.)	Outset	Inset	Max Load & Inflation
10-hole, stud located, ball seat mounting – 11.25" bolt hole circle							
Accuride	Steel	29802	White	129	4.95	4.32	11000 @ 110
Hayes Lemmerz	Steel	10060TW	White	121	4.83	4.32	11000 @ 130
10-hole, hub piloted mounting – 285.75 mm bolt hole circle							
Accuride	Steel	29811	White	129	4.95	4.32	11000 @ 110
Hayes Lemmerz	Steel	10059TW	White	121	4.83	4.32	11000 @ 130

NOTE: The table provided is for reference only. Wheel specific questions should be directed to the wheel manufacturer.
Accuride at www.accuridecorp.com
Hayes Lemmerz at www.hayes-lemmerz.com

Truck Technical Specifications

AXLES AND WHEEL ENDS **12-15**

- Axle Identification Tags
- Load Ratings
- Axle Track Widths
- Use of 2" Outset Wheel with MICHELIN® X One® Tires

SPINDLES **16**

OVERALL VEHICLE TRACK AND WIDTH **17**

BEARINGS **18**

ENGINE COMPUTERS **18**

AIR INFLATION AND PRESSURE MONITORING SYSTEMS **19-20**

- The Use of Pressure Monitoring and Inflation Systems with MICHELIN Truck Tires
- Central Tire Inflation Systems on Trailers and Missed Nail Holes

TRUCK TYPE BY WEIGHT CLASS **21-22**

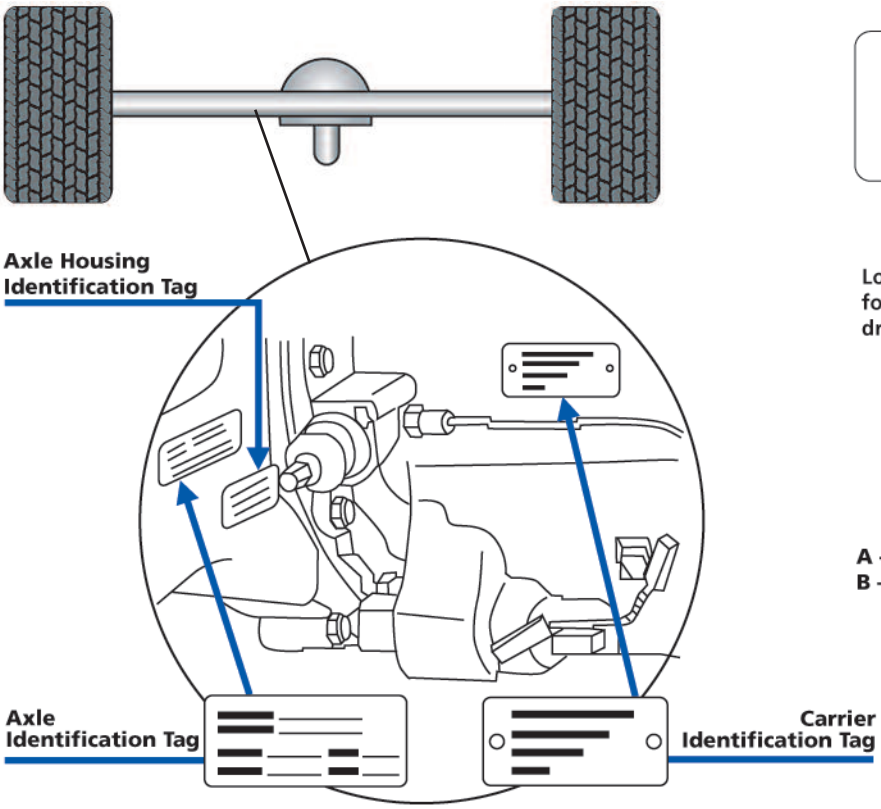
- MICHELIN® X One® Tires in 4x2 Applications

AXLES AND WHEEL ENDS

AXLE IDENTIFICATION TAGS

There are primarily three manufacturers of drive and trailer axles for the long haul highway market. ArvinMeritor™, DANA, and Hendrickson all supply trailer axles, while only DANA and ArvinMeritor™ supply drive axles.

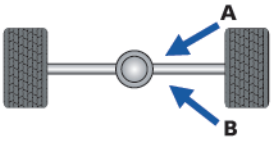
ArvinMeritor™ — DRIVE AXLE IDENTIFICATION



AXLE IDENTIFICATION TAG INFORMATION

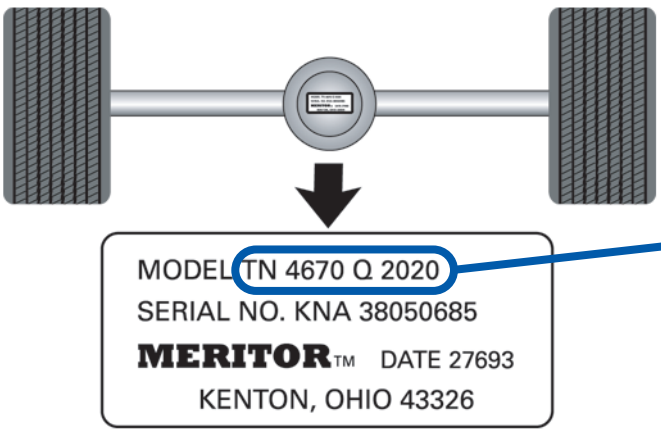
Model No. _____
Customer No. _____
Serial No. _____ Plant_____
Ratio _____

Identification Tag
Location of the identification tag, or stamp number, for the axles. Location is determined from the left driver side looking toward the front of the vehicle.



A — Front engine drive — Right rear, next to cover
B — Rear engine drive — Left or right rear, next to drive unit

ArvinMeritor™ — TRAILER AXLE IDENTIFICATION



Beam Type
T = Tubular

Beam Capacity

lbs	kg
N = 22,500	10,206
P = 22,500/25,000/30,000	10,206/11,340/13,608
Q = 25,000/30,000	11,340/13,608
R = 22,500/25,000	10,206/11,340

T N 4 6 7 0 Q 2 0 2 0

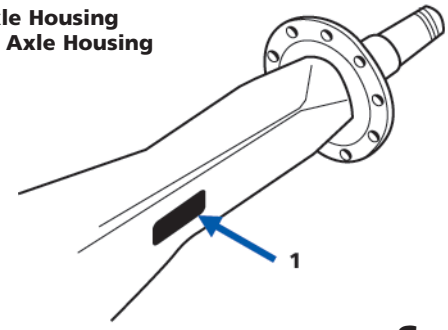
Modification
1 = Single Wheel
2 = Intermodal
3 = Bolted on Brakes
4 = Manual Bearing Adjustment
6 = Positive Bearing Adjustment
8 = 0.625" Nominal Wall Axle

Brake Width
1 = 10" (25 cm)
6 = 6" (15 cm)
7 = 7" or 7.5" (18-19 cm)
9 = 8" (20 cm)
0 = No Brakes

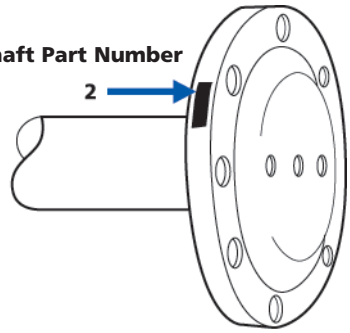
NOTE: The graphic provided is for reference only. Axle specific questions should be directed to the axle manufacturer.

DANA — DRIVE AXLE IDENTIFICATION

Parts Identification
Axle Housing
1 - Axle Housing



Axle Shaft
2 - Axle Shaft Part Number



S 26 - 1 7 0 D

D - Dual Drive Forward Axle with Inter-axle Differential
G - Single Rear Axle (Global)
R - Dual Drive Rear Axle
S - Single Rear Axle (N.A.)
T - Tridem Configuration

GAW Rating
X 1000 lbs. (N.A.)
x 1 TN (Global)

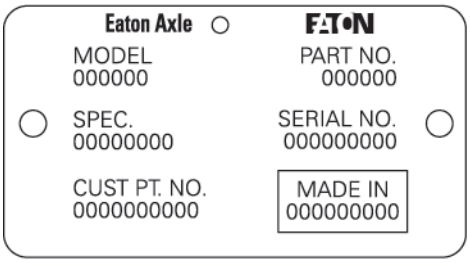
Gear Type
1 - Standard Single Reduction
2 - Dual Range
5 - Helical Reduction
6 - Helical Overdrive

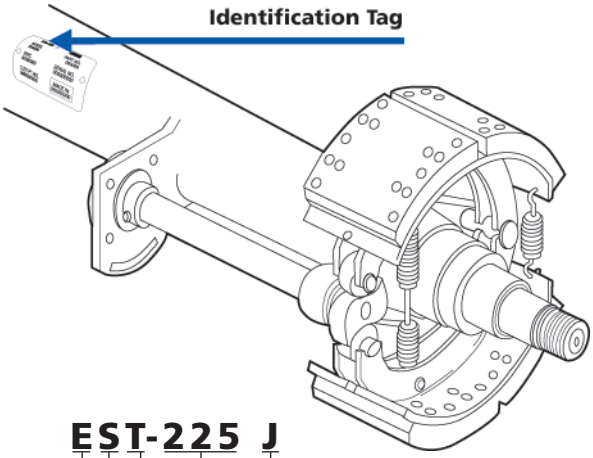
Design Level

Head Assembly Series

Options
B - Bus/On-Center Bowl
C - Controlled Traction
D - Differential Lock
E - High Entry Single
F - Flipped/Rolled Over
H - Heavy Wall
I - Integral Brake
L - Limited Slip
N - No Spin Differential
O - Offset Change
P - Lube Pump
R - Retarder Ready
U - Unitized Spindle
W - Wide Track Housing

DANA — AXLE IDENTIFICATION





0 00 000 0000

Serial Number
Julian Date
Year
Manufacturer's Location

EST-225 J

Spindle Code
J - "J" Trailer Spindle
D - "D" Trailer Spindle
P - "P" Trailer Spindle
Tube Capacity Rating (x 100 lbs.)
Brake Code
T - 16 1/2" x 7" Brake
R - 15" x 8 5/8" Brake
Extended Service Brake
Eaton

NOTE: The graphic provided is for reference only. Axle specific questions should be directed to the axle manufacturer.

HENDRICKSON — TRAILER AXLE IDENTIFICATION

INTRAAX SYSTEM
Ultimate System Integration™
MODEL
DESC.
SERIAL NO.
TRI-FUNCTIONAL® BUSHING
HENDRICKSON
Trailer Suspension Systems
CAPACITY SUSPENSION / AXLE ONLY
23000 LB
MANUFACTURED UNDER ONE OR MORE OF THE FOLLOWING PATENTS:
US PATENT NOS.: 5171036, 5366237, 5720489, 5833253, 5996981, 6024417, 6213507, 6240806, 6425593, 6439587.
FOREIGN PATENT NOS.: AU631071, BR-PI9102874-4, NZ334263, MX177978, BR-PI9004278-7, CA2108724, NZ272361, KR115034, CA2043786, DE69103498, EP474331, AU666572, AU707479, MX178325, EP600198, MX190976,NZ260280, ES2059060, WO-96/36522, WO-98/09094, AU749562, AU750171, MX214622, NZ516218, PL185697. OTHER PATENTS PENDING.

Model: VANTRAAX®.5836
Description: HKANT40K 165RH 77USHD MA X7SH
U - HUS Spindle

Model: VANTRAAX®.2157
Description: HKAT 50K 16RH 71NST QD X7SHD
N - N Spindle

Model: INTRAAX®.2597
Description: AAT 23K 14RH C77USST 7S
U - HUS Spindle

Model: INTRAAX®.3598
Description: AAL 30K 9RH 71PST
P - P Spindle

NOTE: The graphic provided is for reference only. Axle specific questions should be directed to the axle manufacturer.

LOAD RATINGS

The load/capacity rating of a given axle is determined by the axl housing strength, bearing capacity, and hub capacity. For some ult lightweight axles, the reduced axle housing thickness may be the w link, but usually it is the bearings or hub that will be the limiting fa

These axles and components are typically designed under the assumption that the action line of the tire load is located between bearings. This is typically found with dual tire mounting or with si tires with very low outset wheels with the axle rating being similarl determined.

If wheels with greater outset are used, the resulting cantilever loading may require lower ratings for some of the axle components. The level of de-rating and the implications there determined by the axle manufacturer, so they should be consulted prior to fitment of outset single wheels.

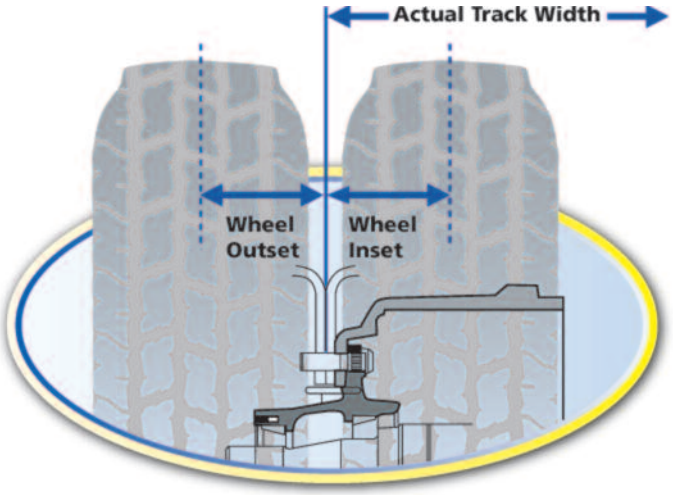
Prior to contacting the axle manufacturer, you should consult the axle identification tag to obtain the following information:

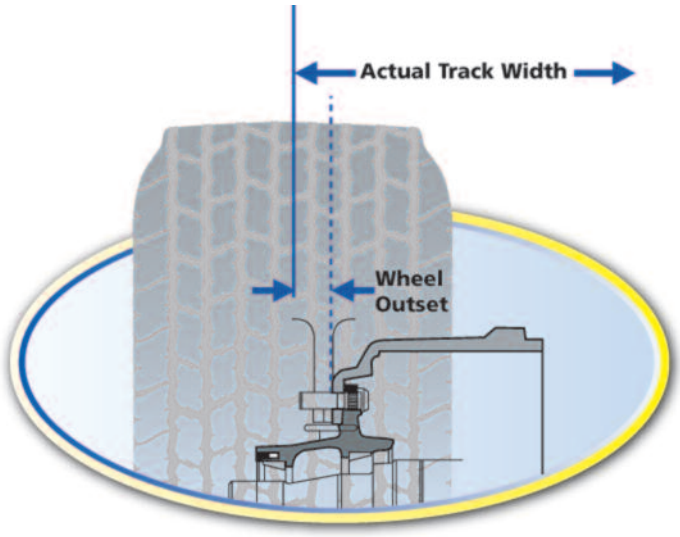
– Axle Manufacturer
– Manufacturer's Model #
– Axle Serial Number
– Axle Capacity

Information on actual operational axle loading (as opposed to rated load) is crucial, since the axle manufacturer may recommend de-rating the axle below the vehicle manufacturer's GAWR (Gross Axle Weight Rating).

With this data in hand, contact the particular axle manufacturer numbers listed below for specific application information.

ArvinMeritor™ – www.arvinmeritor.com
DANA – www.dana.com
Hendrickson – www.hendrickson-intl.com





USE OF 2" OUTSET WHEELS WITH MICHELIN® X ONE® TIRES

The MICHELIN® X One® tires (445/50R22.5 and 455/55R22.5) require the use of 14.00 x 22.5" wheels. The majority view of the wheels currently offered have a 2" outset.

Some axle and hub manufacturers have clarified and confirmed their position concerning the use of such wheels with their respective components. While the position of the component manufacturers is not totally consistent, the majority view concerning the retrofit of dual with MICHELIN® X One® tires can be summarized as follows:

Axle Type*	Spindle Type	Wheel Recommendation
Drive axles	"R"	2" outset wheels
Trailer axles	"P"	2" outset wheels
Trailer axles	"N"	Check with component manufacturer.

* Many other axle and spindle combinations exist. Contact axle manufacturer.

Truck and trailer manufacturers may have different specifications. For optimum track width, stability, and payload, end-users should talk to their trailer suppliers about the use of 83.5" axles with zero outset wheels.

A trailer specified with 83.5" inch axles is intended for single tire use. Switching to dual tire configuration could exceed the legal maximum overall width of 102".

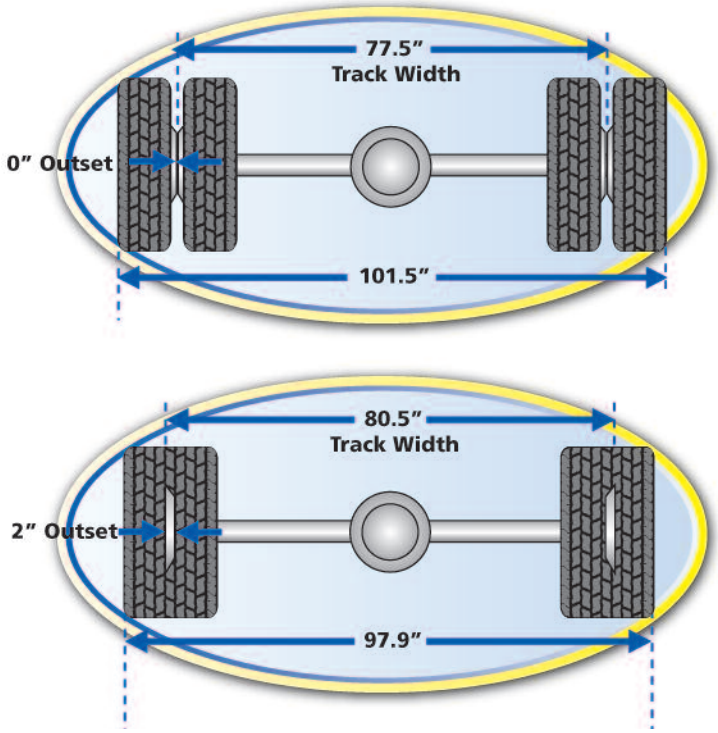
End-users that have retrofitted vehicles with 2" outset wheels should contact their respective vehicle, axle, or component manufacturers for specific application approvals or maintenance recommendations.

AXLES TRACK WIDTHS

Three standard axle track widths are available. They are 71.5", 77.5", and 83.5". Check with the axle manufacturers for other sized options.

Axle width is measured from spindle end to spindle end (the two widest points).
Axle track is a center to center distance between the dual or center of single tire to center of single tire.

71.5" is a standard axle track width found on bulk and liquid tankers.
77.5" is a standard axle track width for 102" wide trailers.
83.5" is the newer wider track axle intended for use with wide singles and 0" outset wheels for increased track width, stability, and payload.

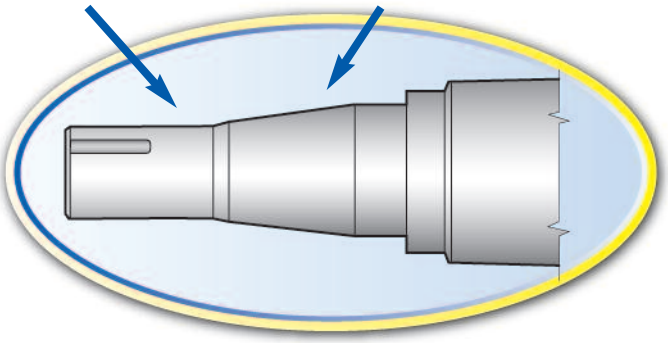


NOTE: Measurements are nominal values and could vary with manufacturer.

SPINDLES

There are three main spindle types you will encounter when retrofitting MICHELIN® X One® tires: “N”, “P”, and “R”.

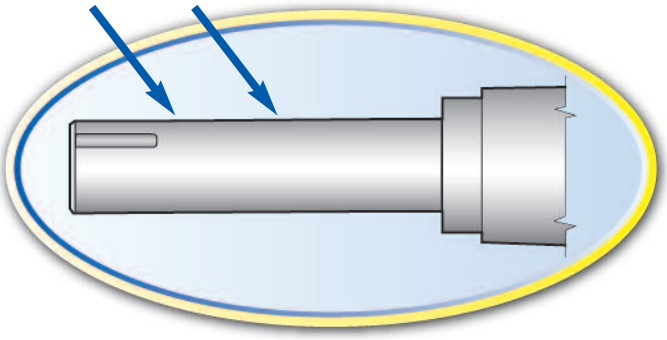
Outer bearing smaller than inner bearing.



N-TYPE SPINDLES (TAPERED)

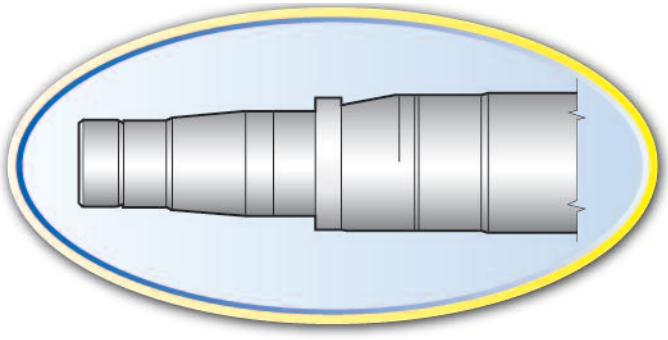
N-type spindles are tapered to the outboard end and utilize a smaller outboard bearing and a larger inboard bearing.

Outer and inner bearings the same size.



P-TYPE SPINDLES (STRAIGHT)

P-type is a parallel spindle design (straight shaft) and utilizes the same sized bearings inboard and outboard. This is generally a heavier duty axle end.



R-TYPE SPINDLES

R-type is a drive axle spindle configuration. The R-type spindle for drive axles is typically straight with bearings of nearly the same size.

The best way to determine what type of spindle may be fitted to a given axle is to reference the axle ID data plate affixed to the axle or the suspension ID tag as described on Pages 12-14. The following photos display actual tag placements.

Tag Placement

Tag Placement

A quick rule of thumb is to measure the hub cap. N-type is usually ~4.5" and the P-type is usually ~6.0".

N-Type Spindle

P-Type Spindle

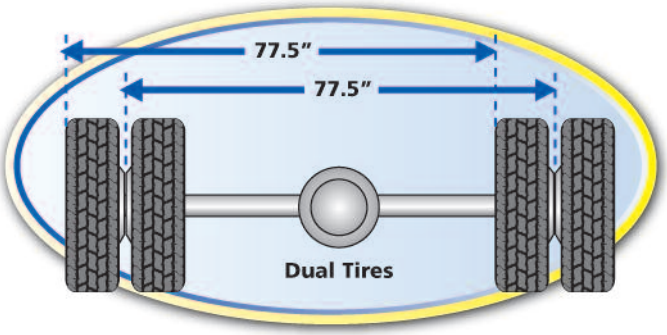
Overall Vehicle Track and Width

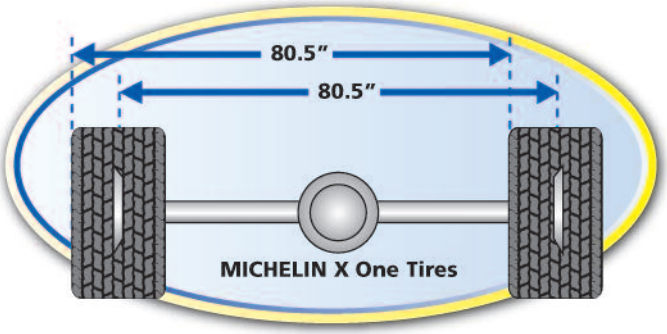
Vehicle track width is determined by taking the axle track width and adding or subtracting the left and right wheel outsets or insets respectively.

An easy way to measure this yourself is to start on the left side of the axle, hooking your tape on the outside edge of the tread. Stretch the tape to the right side of the axle and measure to the inside edge of the tread.

Take the measurement where the tape measure crosses the left edge of the right side tire's tread.

The measurement you have just taken is your vehicle's track width. Simply put, it is the center to center distance of your tires.





This method also works well for determining the track width on dual tires.

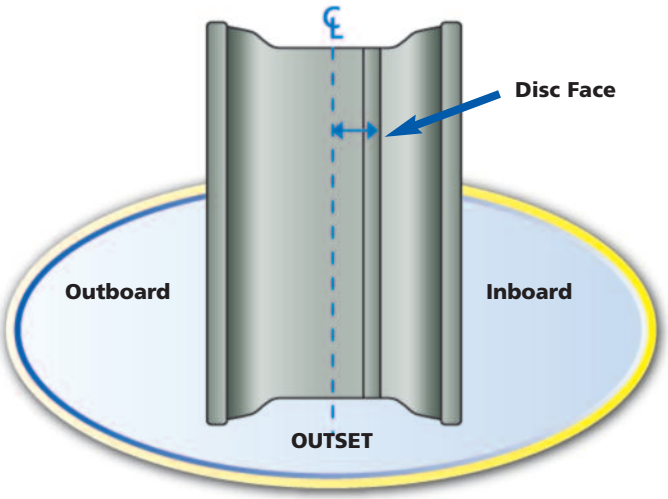
Without changing the width of your axle, your track width can change depending on your wheel outset or inset.

Outset: The lateral distance from the wheel centerline to the mounting surface of the disc.

Outset places the rim centerline outboard of the mounting (hub face) surface.

Inset places the rim centerline inboard of the mounting (hub face) surface or over the axle.

WARNING If 2" outset wheels are mounted backwards, this will significantly reduce track width and could affect vehicle stability.



Overall width of axle assembly is determined by measuring the outer tire sidewall to outer tire sidewall. This measurement is taken at the top of the tire's sidewall to avoid measuring the sidewall deflection. The Federal DOT (Department of Transportation) maximum allowed is 102".

For a close approximation, clip the end of the tape measure on the left tire's outside sidewall and pull the tape to the outer sidewall of the outer tire on the opposite side. If your measurement is close to 102", then a more precise method will be required.

Bearings

Wheel-end bearings for trucks and trailers are typically the tapered roller type with either grease, semi-fluid grease, or oil level lubrication. Anticipated bearing life is compared by running an ANSI (American National Standards Institute) L10a test to statistically determine the fatigue life. The test variables are wheel end loading (amount and location), bearing end-play, tire and wheel weight, tire static loaded radius, and duty cycle (vehicle speed and turn frequency and lateral g loading). The output is L10a Weighted Bearing System Life in miles.

The common belief among fleet maintenance technicians is that bearings do not fail or wear out in normal service unless subjected to loss of lubricant, excessive endplay, or excessive preload.

Using standard bearings with a 2" wheel outset on a N-type spindle arrangement does reduce the L10a bearing life expectancy. Bearing manufacturers offer enhanced bearings for trailer and drive axle applications that provide L10a life with 2" outset single wheels near that of conventional bearings with dual wheels.

These bearings have an extra roller with a slightly different contact geometry between the cup and cone and are machined to tighter tolerances and a smoother surface finish.

Timken's 454-Series™ bearings*:

- One bearing for Dual and Wide Singles
  - – Specially designed to handle the 2" outset loads
  - – Allows consistency within fleet
  - – Provides flexibility of wheel arrangements
- Compatible with industry standard components
  - – Use with popular axle and hub designs
  - – Can retrofit onto existing equipment

*For more information on the Timken® 454-Series™ bearings, visit The Timken Company at www.timken.com.

IMPORTANT: Some wheel bearing assemblies have warranties that may be voided when the wheel ends are disassembled. Contact your axle and/or suspension component supplier before removing any wheel end components.

	Cone	Cup
R Drive Inner	NP454594	NP454592
R Drive Outer	NP454580	NP454572
N Trailer Inner	NP454248	NP454210
N Trailer Outer	NP454049	NP454011
P Trailer Inner & Outer	NP454445	NP454410

Engine computers / fuel economy

Tire revolutions and axle ratio are inputs to the Engine Control Module (ECM) to manage road speed. Changing from dual to MICHELIN® X One® tires may require changing the Tire Revolutions per Mile (Tire Revs./Mile) value in the ECM in order to ensure speed, distance, and fuel economy are accurate per indications. Reference the MICHELIN® Truck Tire Data Book (MWL40731) for proper Tire Revs./Mile values for the MICHELIN® X One® tires you chose.

To accurately determine fuel efficiency gains from switching to MICHELIN® X One® tires, it is recommended that SAE (Society of Automotive Engineers) Fuel Test J1376 be conducted to verify the values determined by the engine computer.

New EGR (Exhaust Gas Recirculation) engines may use diesel fuel to clean the DPF (Diesel Particulate Filter). When checking fuel usage please be aware of the additional fuel used during regeneration of the DPF.

AIR INFLATION AND PRESSURE MONITORING SYSTEMS

Proper inflation pressure is critical to the overall performance of all tires on the road today.

Today's radial truck tires will lose less than one psi per month due to air migration through the casing. Faster loss of inflation can only occur in conjunction with some sort of leak in the wheel, valve stem, or tire structure. Whatever the source of the leak, it must be identified and corrected to avoid further damage to that component, possibly leading to a compromise in safety.

AVAILABLE SYSTEMS

Tire pressure monitoring systems have been legislated for all vehicles by the TREAD Act (Transportation Recall Enhancement, Accountability, and Documentation). The implementation schedule is in place for vehicles with gross vehicle weight (GVW) below 10,000 lbs, but is yet to be determined for heavier vehicles. The existing systems "read" the pressure in the tire via a sensor mounted on the valve stem, wheel, or inside the tire. Sensors that are not physically inside the tire/wheel cavity cannot accurately measure the internal air temperature, so are they unable to determine the "cold inflation pressure." In addition, external sensors may require additional air line plumbing that creates additional potential leak points.

Monitoring systems may provide either pressure data or a low pressure warning. The pressure data may be "hot" or "cold" pressure, so it is necessary that the person viewing that data fully understands which pressure is reported and what it means. Low pressure alarm systems only alert the driver when the pressure in a particular tire (or pair of dual tires if linked together) is below some fleet-chosen minimum. This value may be preset by the sensor supplier or may be programmable by the fleet. Tire manufacturers, through the Rubber Manufacturers Association (RMA), have agreed that a tire must be considered flat if the inflation pressure is 20% or more below the pressure recommended for that tire. A flat tire must be removed from the rim, thoroughly examined, and properly repaired prior to re-inflation and use.

Some systems provide inflation pressure information at the sensor site only, so the driver must walk around the vehicle to gather/view either the pressure reading or low pressure warning. Other systems transmit the information to the cab where it may be viewed by the driver, and/or sent to a central facility if the vehicle is tracked by satellite

Inflation-only systems are designed to add air to maintain a preset pressure but do not have the ability to reduce the pressure should a tire be over inflated. These systems can account for slower leaks (determined by the air delivery capacity of the system) and provide some warning to the driver when the system is energized (adding air) or when it cannot keep up with the leak. Almost all inflation-only systems use air from the vehicle air brake system, so they will be limited in max pressure and available volumetric flow. In addition, these systems are usually only applied to trailer axles where plumbing the air supply line is easier.

Tire inflation systems may add air to tires determined to be below some fleet chosen pressure. Some Central Tire Inflation (CTI) systems will also allow pressure reduction on any tire on the vehicle to maintain some given pressure level. Such systems are rather expensive and more often used only on specialty vehicles (Military, emergency response, National parks, etc.)

A key factor in any monitoring or inflation system is determining whether the target or set pressure is a "hot" pressure or a "cold" one. This should be discussed with your tire manufacturer's representative.

Air inflation systems are not guarantees against low pressure situations. All vehicles should still be subject to pre-trip inspections, and systems operation should be verified routinely.

THE USE OF PRESSURE MONITORING AND INFLATION SYSTEMS WITH MICHELIN TRUCK TIRES

In view of the increasing visibility and promotion for the use of pressure monitoring and/or inflation systems, Michelin takes the following position:

- Michelin has not and cannot test every system that is being marketed/manufactured for effectiveness, performance, and durability.
- The use of these systems does not nullify the MICHELIN truck tire warranty unless it is determined that the system somehow contributed to the failure or reduced performance of the tire.
- Proper air pressure maintenance is important for the optimal performance of the tires, so it is important to make sure the system can maintain the pressures needed and/or can detect accurately when the pressures are outside of the normal operating range(s) for the loads being carried.
- **It is the responsibility of the system manufacturer to ensure that the tires are inflated as rapidly as possible to the optimal operating pressure in order to prevent internal damage to the tires.**
- Michelin strongly urges the customer to put the responsibility on the system's manufacturer to prove and support their claims.

In addition to the foregoing, please refer to the MICHELIN® Truck Tire Warranty Manual (MWE40021) for a general discussion of what is and is not covered by the warranty.

CENTRAL TIRE INFLATION SYSTEMS ON TRAILERS AND MISSED NAIL HOLES

Central Tire Inflation (CTI) systems on trailers can sometimes make slow leaks caused by nails or other small objects penetrating the crown area of the tire undetectable. A slow leak can be compensated for by the air inflation system. The warning light of the CTI system will only come on if the pressure in the tire drops below a certain percent (usually 10%) of the regulated preset pressure. Even when the pressure drops below this point, the light will go off if the system is able to restore and maintain the preset pressure.

The tires on trailers with CTI systems should be visually inspected before and after use and any imbedded objects removed and the tire repaired. An undetected imbedded object remaining in the tire can allow air infiltration and consequently a possible catastrophic failure of the sidewall.

TRUCK TYPE BY WEIGHT CLASS

CLASS 6 19,501 to 26,000 lbs. GVW	CLASS 7 26,001 to 33,000 lbs. GVW	CLASS 8 33,001 lbs. and over	TRAILER Weight: Not specified	NOTES
 TOW	 HOME FUEL	 FUEL	 DRY VAN	
 FURNITURE	 TRASH	 DUMP	 DOUBLES	
 STAKE	 FIRE ENGINE	 CEMENT	 LIQUID TANK	For information on the MICHELIN® X One® tire for the 4x2 application, refer to page 22.
 COE VAN	 SIGHTSEEING/COACH	 REEFER	 DRY BULK	**GVW – Gross Vehicle Weight** The total weight of the loaded vehicle includes chassis, body, and payload.
 SCHOOL BUS	 TRANSIT BUS	 TANDEM AXLE VAN	 LOGGER	**GCW – Gross Combination Weight** Total weight of loaded tractor-trailer combination includes tractor-trailer and payloads.
 SINGLE AXLE VAN	 RV	 INTERCITY BUS	 PLATFORM	
 BOTTLER		 LARGE RV	 SPREAD AXLE	**GAWR – Gross Axle Weight Rating** Maximum allowable load weight for a specific spindle, axle, wheel, and rim combination.
 LOW PROFILE COE		 TANDEM REFUSE	 DROP FRAME	
	GCW TO 65,000	GCW TO 80,000	 DUMP	Identical vehicles may appear in different vehicle weight classes. This is because of a difference in the components installed in each vehicle such as engines, transmissions, rear axles, and even tires that are not readily discernible in the external appearance of those particular vehicles.
	 HIGH PROFILE COE	 LOW PROFILE TANDEM COE	 REEFER	
	 MEDIUM CONVENTIONAL	 HEAVY CONVENTIONAL	 DEEP DROP	
		 HEAVY TANDEM CONVENTIONAL	 AUTO TRANSPORTER	
		 HEAVY TANDEM CONVENTIONAL SLEEPER	 DOLLY	

RECOMMENDATION FOR USE OF MICHELIN® X ONE® TIRES IN 4x2 APPLICATIONS

4x2 Articulated Vehicles

Handling studies have indicated that for certain types of commercial single axle (4x2) tractors pulling trailers, handling may be degraded in the event of a rapid air loss when fitted with single tires. Michelin recommends that single axle tractors fitted with MICHELIN® X One® tires on the driven axle always be equipped with an Electronic Stability Program (ESP).

4x2 Straight Chassis Vehicles

Testing has indicated that handling of 4x2 straight chassis vehicles fitted with single tires on the drive axle may be degraded in the event of a rapid air loss, especially when coupled with panic braking. Class 6 and 7 straight trucks fitted with MICHELIN® X One® tires should also be equipped with anti-lock brake system (ABS) and/or ESP. Such degradation in handling has been observed both in curve, lane change, and straight line driving.

Michelin still maintains that all types of motor vehicles can be controlled in the event of a rapid air loss under normal, legal driving conditions. Vehicle control in a rapid air loss situation is a matter of driver education and training. To assist with this training, Michelin has produced a video entitled "Rapid Air Loss, Truck – The Critical Factor" to instruct drivers on how to handle a rapid air loss situation.

To download or view the video - "Rapid Air Loss, Truck – The Critical Factor" - please visit our web page at www.michelintruck.com/michelintruck/toolbox/videos-demos.jsp

For additional information, please contact your local MICHELIN sales representative, or contact Michelin using the website at www.michelintruck. com.

MICHELIN® X One® Tire Maintenance

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MICHELIN
A better way forward

MICHELIN® X ONE® TIRE – MOUNTING

MICHELIN® X One® tires are easily mounted on 14.00 x 22.5" approved wheels using procedures similar to that of tires mounted in dual configuration. Correct steps and safety practices should be followed to help ensure a proper mount of the tire and wheel assembly. These points are covered in the MICHELIN Truck Tire Service Manual (MWL40732).

MOUNTING SETUP

Be sure to use tools in good condition, along with approved vegetable-based lubricants, with the proper ratio of lubricant-to-water. **NO** petroleum oils/grease, silicone oils, or solvent-based lubricants should be used, as these can swell and damage rubber. The lubricant and brushes should be free of contaminates. In addition make sure to use all personal protective equipment like safety glasses, steel toe boots, and gloves when mounting assemblies.

Mounting tools can include traditional T-45 irons, wide base Golden tool, and approved mounting machines.

Ensure a good area is available to perform your tire work. Floor mats or pads would be beneficial. Make certain all components (the tire, wheel, and valve) are identified as correct for the assembly. Inspect each component for any damages and/or conditions that would render it unserviceable, and replace item if necessary.

Mounting Tools

Work Area

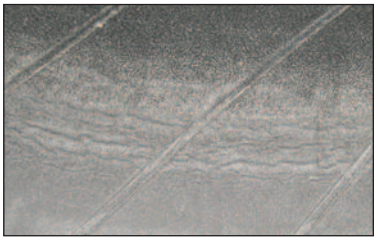
WHEEL PREPARATION

Make sure the wheel is clean of rust and debris, and the mounting surface is smooth. Damaged and leaky valve stems, O-rings, and grommets must be replaced. You should include in your tire mounting procedures replacing the valve with a new one for every mount to safeguard against any possible used valve/O-ring issues. Ensure the valve stem is installed using the proper torque value: 80-125 in/lbs (7-11 ft/lbs) for aluminum wheels and 35-55 in/lbs (3-5 ft/lbs) for tubeless steel wheels.

INSPECTING FOR DAMAGES

A safety reminder prior to mounting a new tire: check for any signs of damage from shipping or storage to the sidewalls, inner liner, or beads. For a used/repaired/retreaded tire, check for signs of low inflation pressure or run-flat conditions on the inner liner (marbling, wrinkles, and discoloration).

Also, inspect the bead areas for damage, and if a repair(s) is noted, inspect to make sure it's in good condition. If the tire is deemed ready for service, lubricate both beads of the tire and the wheel.



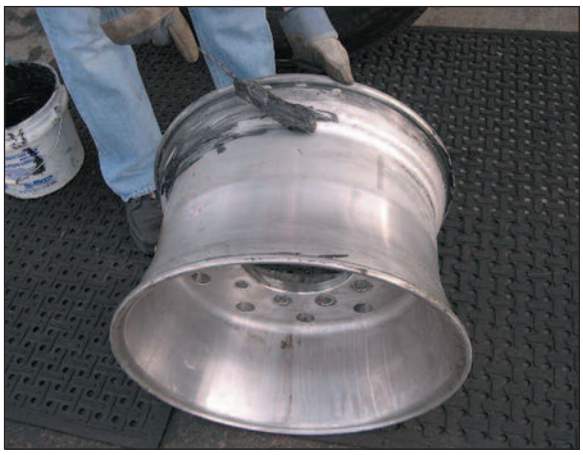
Run-flat Wrinkling

Run-flat Ring in Flex Zone

LUBRICATING THE TIRE AND WHEEL

When applying lubricant to the wheel, lubricate the entire wheel surface from flange to flange. Apply a liberal amount - lubricating both components will assist in the ease of the mount and will ensure proper seating of the beads on the wheel.

Lubricating the Tire



Lubricating the Wheel

MOUNTING THE MICHELIN® X ONE® TIRE

The tire should be mounted and inflated before the lubricant dries.

With the wheel short side up (narrow side), lay the tire over the wheel at the valve side and work it on with proper tubeless tire tools, making full use of the drop center well (when using a T-45 iron – use the curved end with a ledge).

Using same iron and method, mount the second bead. When mounting the second bead, keep one foot in place to keep the bead seated, and move the other foot around the tire as each part of the bead is seated to keep it in place.

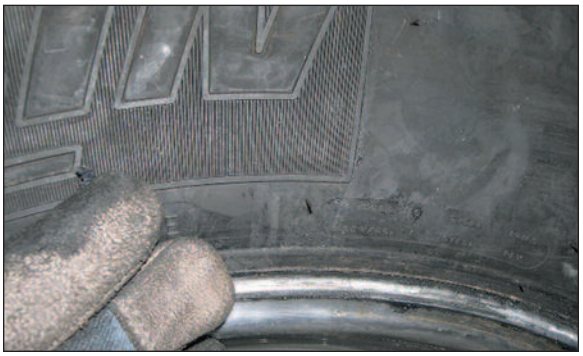
Padded bead keepers can be useful during the mounting process by keeping the bead fixed on the flange, thus avoiding the need to keep a foot in place.

Lay the tire/wheel assembly horizontally and inflate to no more than 5 psi to correctly position the beads on the flanges.

Place the assembly in a safety cage (per Occupational Safety and Health Administration (OSHA) standards) and continue airing to 20 psi. An extra wide safety cage is available for safe inflation of the tire. In most cases, a standard cage can accommodate the MICHELIN® X One® assembly. Check the assembly carefully for any signs of distortion or irregularities from run-flat. Closely inspect the sidewalls for bulges/pulled cables that would indicate the tire ran underinflated. You should also listen for signs of deterioration in the casing cables (i.e., crackling sound).

If run-flat is detected, scrap the tire. If no damage is detected, continue to inflate to the manufacturer's recommended operating pressure as listed in the load and inflation tables.

Please note the lower sidewall "beauty rings", and ensure the ring is positioned concentrically in relation to the rim flange with no greater than 2/32" of difference found circumferentially. If the bead(s) did not seat, deflate tire, relubricate the beads and wheel flanges, and re-inflate.



Finally, give the valve stem a check for leakage or air loss with a squirt of leak finder (soap and water). If no leak is found, seal with a metal valve cap.

MICHELIN® X ONE® TIRE – DEMOUNTING

All tires must be completely deflated prior to loosening any nuts and demounting from the vehicle.

Deflate the tire by removing the valve core. Check the valve stem opening with a wire to make sure it is not plugged.

With the tire assembly lying flat, break the bead seat of both beads with a bead breaking tool.

Apply the lubricant to all surfaces of the bead area on both sides of the tire. Make certain that the flange with the tapered ledge that has the shortest span to the drop center is facing up.

WARNING

DO NOT USE HAMMERS of any type. Striking a wheel/rim assembly with a hammer can damage both the tire and the wheel and is a direct OSHA* violation.

* Occupational Safety and Health Administration

2-BAR DEMOUNT METHOD

Beginning at the valve, remove the first bead using the curved end of the tire irons. Place the two irons 6-8" apart and “walk” through towards the center of the assembly, placing both irons on the opposite flange. This will lift the first bead up over the flange.

Remove one of the irons, and continue to work it around the tire bead taking small “bites” until the entire bead is removed.

3-BAR DEMOUNT METHOD

This method is similar to the 2 bar method with a third iron inserted 8" from the first two. With the first two irons, “walk” through towards the center of the assembly, placing both irons on the opposite flange. This will lift the first bead up over the flange. Leave both irons in this position. With the third iron, “walk” through towards the center of the assembly. This should remove the first bead from the wheel. Remove the third bar and take additional "bites" if necessary to fully remove the first bead from the wheel.

Make sure to have adequate lubrication, and use the irons correctly to eliminate tire and/or wheel damage.

DEMOUNTING THE SECOND BEAD

Now demount the second bead. There are two methods to accomplish this task.

FIRST METHOD

The first method is to position the tire/wheel assembly upwards, with the short side at twelve o'clock. Place smooth/flat end of two irons under the tire bead, and turn the irons to lock the lip against the flange of the wheel. Carefully lower assembly, using an up and down rocking motion, and the tire will release from the wheel.

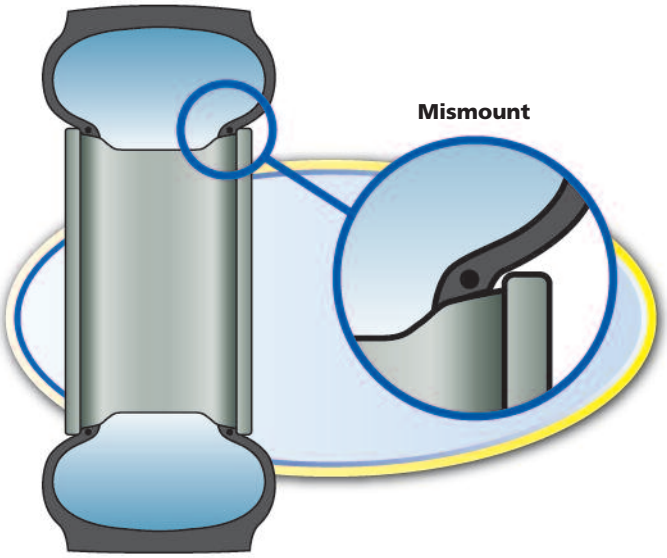
SECOND METHOD

The second method for demounting the second bead is to lay the tire flat on the ground with the tire irons under the flange of the wheel and with a rocking motion, disengage the wheel from the tire. Some technicians find this method to be easier.

The methods described are the most common way of mounting and demounting MICHELIN® X One® tires using standard tire irons. There is a variety of other hand tools and automated machines available through tire supply stores that accommodate MICHELIN® X One® tire products.

Mismount

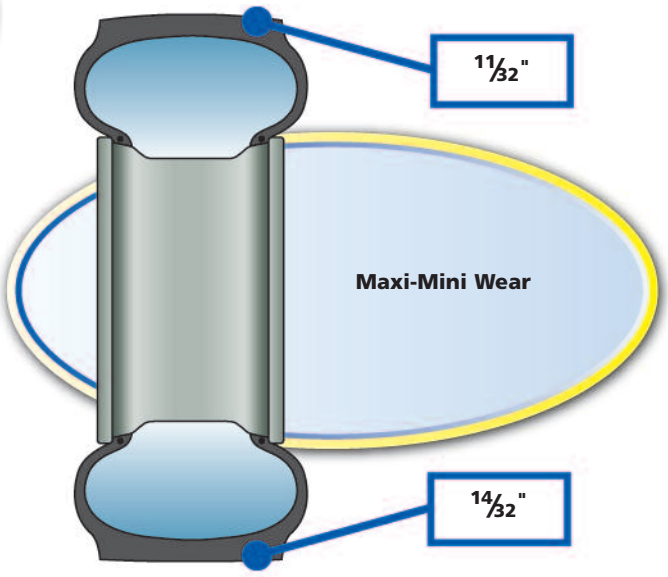
Mismount occurs when the tire beads do not seat fully on the tapered rim flange area of the wheel. As can be seen in this diagram, one of the tire beads has fully seated against the rim flange. But in another small area the bead did not "climb" completely up the tapered area of the wheel. In this area the bead is tucked further under the rim making the sidewall slightly shorter. If the tire continues to run, it will develop "maxi-mini" wear, which is characterized by the tread depth on one side of the tire being deeper than on the other side. In this case, balancing will only be a "band-aid." In other words, the tire may be balanced for a few thousand miles, but as the tire wears, the weights would have to magically shift to another part of the tire/wheel assembly in order to maintain proper balance. Because they don't magically shift to other locations, the driver usually comes back after a few thousand miles saying "whatever you did, it worked for a little while, but now the vibration has come back."



If the tire mismount is not detected immediately, the tire may develop localized shoulder wear. Eventually the tire wear pattern will appear around the rest of the shoulder, sometimes resulting in a noticeable ride disturbance.

If mismount is detected early: deflate, dismount, inspect, re-lube, and re-mount the tire. Sometimes the irregular wear from mismount may be too significant to fix. At this point you can either send the tire to the trailer position or retread the casing.

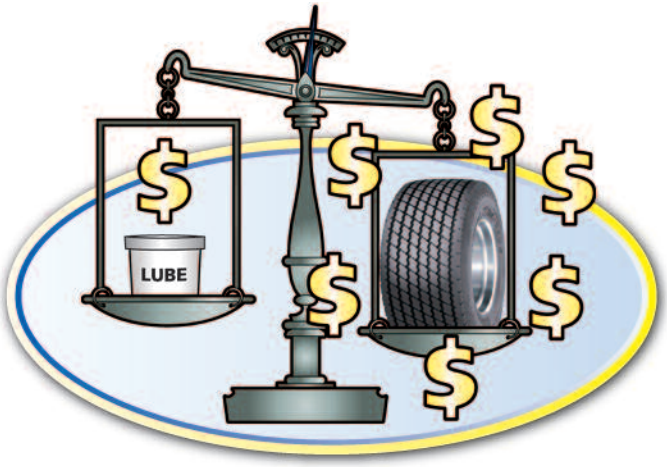
For a detailed discussion on mismount, please refer to the Runout and Match Mounting video from your Michelin Representative.



THERE ARE 3 EASY STEPS TO HELP MINIMIZE MISMOUNTED TIRES:

1. Use a generous amount of tire lube.

Make sure that you only dilute the lube to the specifications of the manufacturer. Some shops will try to dilute the lube additionally to save money. This is a bad idea because the dollar or two you save on a bucket of lube won't be worth replacing a tire due to irregular wear caused from mismount or damaged beads.



2. Inflate the assembly enough to seat the beads with the tire laying horizontally or parallel to the ground.

A good practice to follow that will ensure the tire beads are seated properly is to lay the tire and wheel horizontally on the ground, or better yet, use a 5 gallon bucket as a stand, which will keep the bottom sidewall from touching the ground. The reason you want to seat the beads with the tire horizontal is that if the initial inflation is done with the tire and wheel standing vertically, the weight of the wheel pushing down on the two beads must be overcome in order to center the wheel on the tire. A MICHELIN® X One® tire wheel weighs between 70 and 125 lbs. and it can be very hard to overcome gravity if tire beads are seated with the tire/wheel inflated standing up. Occupational Safety and Health Administration (OSHA) guidelines require the tire to be inflated in an approved safety cage. However, the first 3 to 5 psi of air pressure may be applied to the tire outside the safety cage to properly seat the beads.

Five gallon bucket filled with weights.

3. Inspect the guide rib to ensure that the tire is concentrically mounted.

Using a small machinist's ruler (available at most hardware stores for ~$2), check the wheel flange to the guide rib on your inflated tire. The maximum variation allowed is 2⁄32". You should check the wheel flange to the guide rib at 4 locations: 12:00, 3:00, 6:00, and 9:00.

TIME LABOR STUDY – MICHELIN® X ONE® TIRE VS DUAL ASSEMBLY

MICHELIN® X ONE® TIRE ASSEMBLY

- One tire and wheel: deflating, demounting, re-mounting, and re-inflating.
- Average time for one assembly is around 13-14 minutes.

Lubricating Beads for Dismount

Demounting MICHELIN® X One® Tire

Re-mounting MICHELIN® X One® Tire

Re-inflating MICHELIN® X One® Tire

DEMOUNTING DUAL

- Two tires and wheels: deflating, demounting, re-mounting, and re-inflating.
- One air line.
- Average time is around 18-19 minutes.

Demounting Dual

Re-mounting Dual

Having a second air line will cut down the time by about one third. With multiple air lines, the time is similar to MICHELIN® X One® tire.

MOUNTING ON VEHICLE – MICHELIN® X ONE® TIRE

Mounting MICHELIN® X One® Tire on the Vehicle

HUB PILOTED SINGLE
1 assembly
10 flange nuts (Either side)

STUD PILOTED SINGLE
2 assemblies
10 Cap nuts (Left side)
10 Cap nuts (Right side)

(22 Parts)

MOUNTING ON VEHICLE – DUAL

Mounting Dual on the Vehicle

HUB PILOTED DUAL
2 assemblies
10 flange nuts (Either side)

STUD PILOTED DUAL
4 assemblies
10 inner cap nuts (Left side)
10 inner cap nuts (Right side)
10 outer cap nuts (Left side)
10 outer cap nuts (Right side)

(44 Parts)

In addition, dual wheels must be clocked for valve stem access through the hand holes.

Mounting on hub-centered axles for the MICHELIN® X One® tire or Dual should take ~ 2 minutes for each axle end. While mounting Dual on axles with stud-centered hubs, additional time is required due to the installation of an inner and outer nut for each stud and having to line up hand holes.

TORQUE

Once the tire/wheel assembly is mounted onto the axle end using an air gun, the final torque of each wheel nut must be applied using a calibrated torque wrench to 450-500 foot-pounds. This will only take a minute to perform, and is a safety procedure that will help prevent loose and broken components and potential wheel-offs.

Torque Wrench

AIR INFILTRATION

Air infiltration is an "inside-out" damage. The air inside the tire is much higher (80-120 psi) than atmospheric pressure. Modern tubeless tires have a major advantage over a tube-type tire. When a tube-type tire is punctured, it only takes seconds to become flat. A tubeless tire may take weeks or months for the air to escape – this is because the inner-liner (airtight lining) is integral to the tire. One issue with tubeless tires is that even though they may take a long time to go flat, the air is still trying to get out. As the high pressure air makes its way back through the puncture channel, it can separate products within the tire.

The cause of air infiltration can be from:

- nail or other puncture
- objects left in the tire
- bad repair
- bead damage from mounting/dismounting
- anything that has caused the innerliner to become damaged

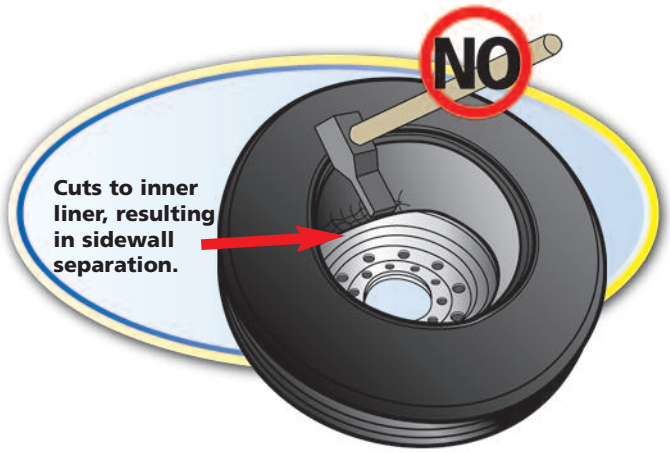
A dual tire can show this effect on the upper sidewall, bead area, or between crown belts. Nine times out of ten, though, it will be in the upper sidewall and manifest itself as a flap or "smiley face."

A more severe form of air infiltration on dual tires results in belt separation and subsequent rapid air loss.

Just as the MICHELIN® X One® tire reacts differently to air pressure settings, it also reacts differently to air infiltration. The usual effect of air infiltration on an MICHELIN® X One® tire can be seen between the top or protector ply and the tread rubber. Air infiltration always results in removing the tire from service (dual or wide single); however, not having belt separation or large sidewall ruptures could prevent rapid air loss events.

AIR INFILTRATIONS ARE AVOIDABLE.

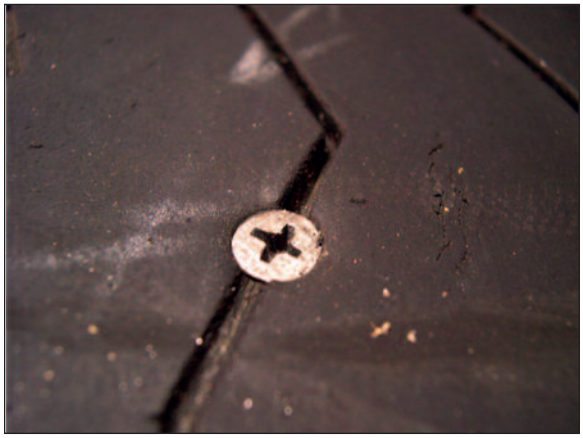
Never use a duckbill hammer to mount tubeless truck tires, as this is the number one cause of bead damages.



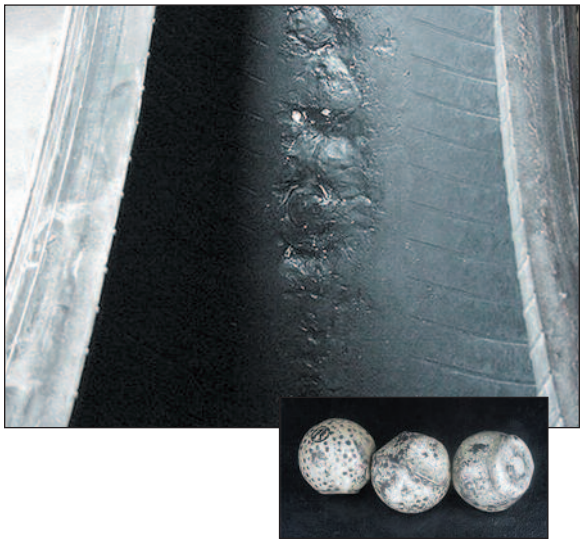
Use proper repair techniques, and inspect all repairs prior to returning tire to service.

REMEMBER: Any object that cuts the inner-liner can lead to air infiltration!

Remove and repair nails, screws, and other penetrations promptly, **BEFORE** they can cause air infiltration.

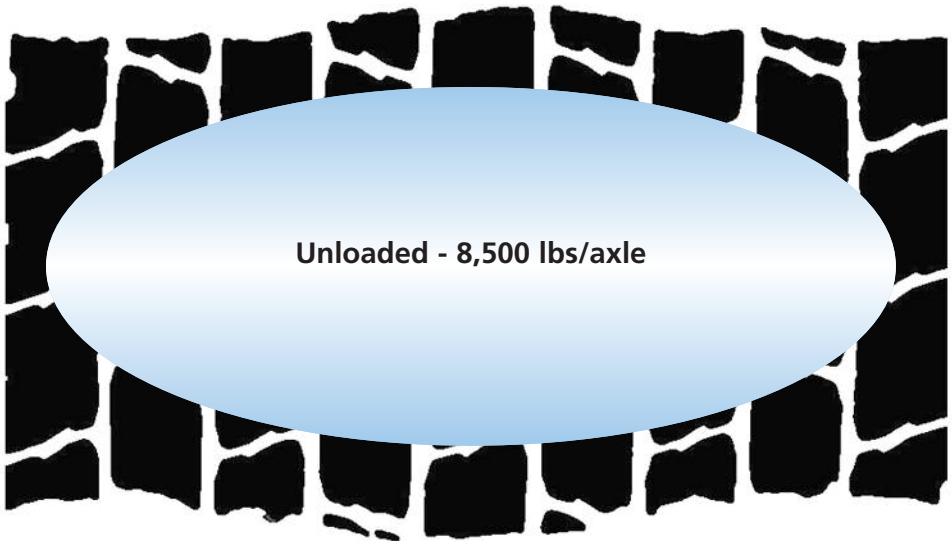


NEVER leave service items inside the tire like repair parts, valves, caps, etc. **NEVER** intentionally place items like golf balls inside the tire to "act" as a balancing agent, as this can lead to inner-liner damage.



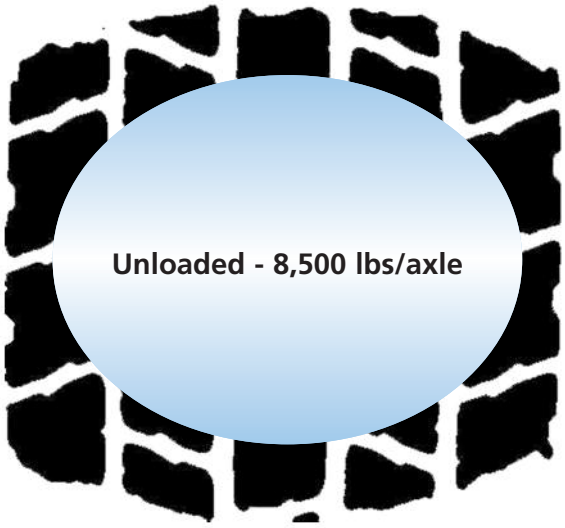
AIR PRESSURE

FOOTPRINT COMPARISONS TO DUAL TIRE FITMENTS

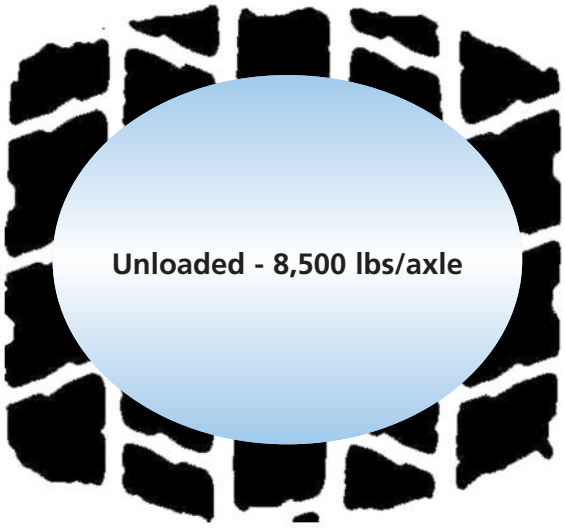


Loaded - 17,000 lbs/axle

FOOTPRINTS:
MICHELIN® X One® XDA®
versus 275/80R22.5



Loaded - 17,000 lbs/axle



Loaded - 17,000 lbs/axle

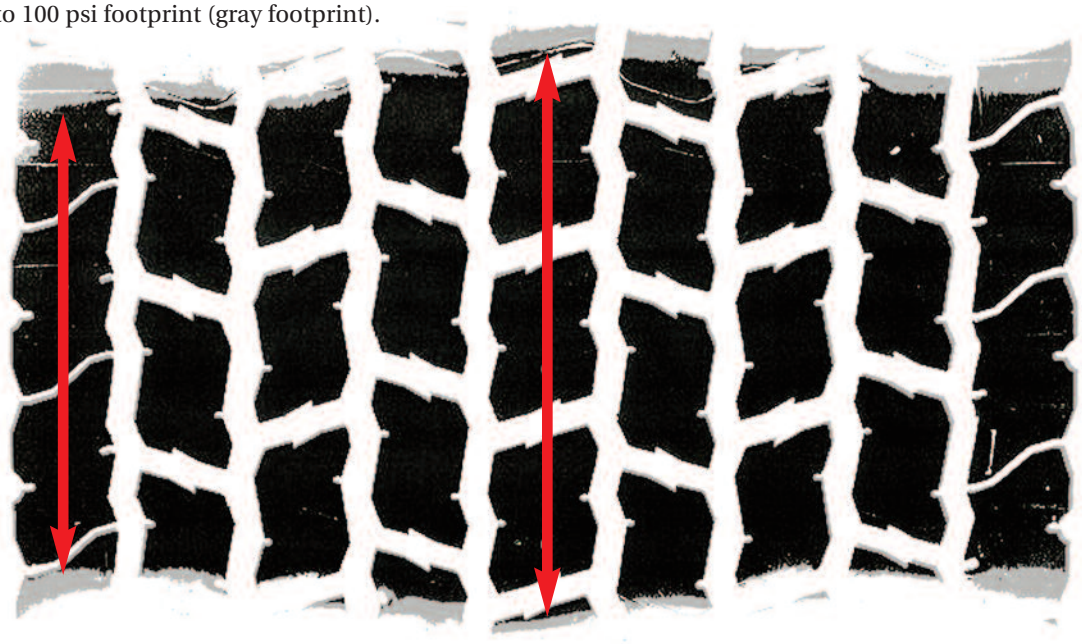
You will notice that switching to single tire fitments causes a slight reduction in footprint area when compared to dual. This will not have a negative impact on your traction.

Your MICHELIN® X One® tire footprint will be dependent on air pressure recommendations and vehicle loads. You should always select a pressure that will adequately support the loads your fleet encounters as defined in the MICHELIN Truck Tire Data Book (MWL40731). Overinflation of your MICHELIN® X One® tires will not only reduce your footprint but can adversely affect handling, wear, and ride characteristics. Overinflating your tires may also result in exceeding the wheel's maximum pressure.

445/50R22.5 MICHELIN® X ONE® AT 100 PSI

120 PSI FOOTPRINT OVERLAID ON 100 PSI FOOTPRINT

The photo below demonstrates what occurs to the footprint when you overinflate the same tire to 120 psi. The overinflated footprint's length and width are reduced (black footprint) when compared to 100 psi footprint (gray footprint).



Shoulder: -33 mm

Center: -13 mm

Tire pressure maintenance advice for users of the new MICHELIN® X One® wide single truck tires

The MICHELIN® X One® family of truck tires is designed to replace dual assemblies on drive and trailer positions in over-the-road applications. Proper air pressure maintenance is critical to obtain optimized performance from these tires. Due to the unique casing design of the MICHELIN® X One® tires, traditional air pressure adjustment practices for dual tires may not apply to MICHELIN® X One® tires. In order to ensure optimal performance of these tires, Michelin North America offers the following guidelines:

1) Cold inflation pressure should be based on maximum axle load in daily operation. Cold inflation pressures must not be lower than indicated in the tables below for actual axle loads. For additional information, please consult the MICHELIN Truck Tire Data Book (MWL40731).
2) A 10 psi incremental change in tire inflation can alleviate most wear forms derived from vehicle anomalies, driver influence and/or application. Always refer to actual axle loads to determine the initial recommended cold inflation pressure.

Application	Location of Wear	Possible Cause
Trailer Tires	Shoulder	Pressure too low
	Center	Pressure too high
Drive Tires	Shoulder	Pressure too high
	Center	Pressure too low

MICHELIN INFLATION CHARTS FOR TRUCK TIRES

To select the proper load and inflation table, locate your tire size below, then match your tire's sidewall markings to the table with the same sidewall markings. If your tire's sidewall markings do not match any table listed, please contact your Michelin dealer for the applicable load and inflation table.

Industry load and inflation standards are in a constant state of change, and Michelin continually updates its product information to reflect these changes. Printed material may not reflect the latest load and inflation standards.

NOTE: Never exceed the wheel manufacturer's maximum air pressure limitation.

S = Single configuration, or 2 tires per axle. Loads are indicated per axle.

WHEEL DIAMETER 22.5"	PSI	75	80	85	90	95	100	105	110	115	120	125	130	MAXIMUM LOAD AND PRESSURE ON SIDEWALL	
	kPa	520	550	590	620	660	690	720	760	790	830	860	900		
445/50R22.5 LRL **X One XDA,** **X One XDA-HT Plus,** **X One XDN2,** **X One XTA,** **X One XTE**	LBS SINGLE	13880	14620	15360	16060	16780	17480	18180	18740	19560	20400			S	10200 LBS AT 120 PSI
	KG SINGLE	6300	6640	6960	7280	7620	7940	8240	8500	8860	9250			S	4625 KG AT 830 kPa
455/55R22.5 LRL **X One XDA-HT Plus,** **X One XDN2,** **X One XTE** ❀	LBS SINGLE	15000	15800	16580	17360	18120	18880	19640	20400	21200	22000			S	11000 LBS AT 120 PSI
	KG SINGLE	6800	7160	7520	7880	8220	8560	8900	9250	9580	10000			S	5000 KG AT 830 kPa
455/55R22.5 LRM **X One XZU S,** **X One XZY3**	LBS SINGLE			16580	17360	18120	18880	19640	20400	21200	22000	22600	23400	S	11700 LBS AT 130 PSI
	KG SINGLE			7520	7880	8220	8560	8900	9250	9580	10000	10240	10600	S	5300 KG AT 900 kPa

❀ With chip and cut resistant tread compound.

MICHELIN INFLATION CHARTS FOR RV USAGE ONLY

In the load and inflation tables, SINGLE means an axle with one tire mounted on each end, while DUAL means an axle with two tires mounted on each end. The loads indicated represent the total weight of an axle end, in an RV application. When one axle end weighs more than the other, use the heaviest of the two end weights to determine the unique tire pressure for all tires on the axle. The maximum cold air pressure for each axle may vary, depending on their weights. This table is applicable for all RV axles, whether or not they are power-driven.

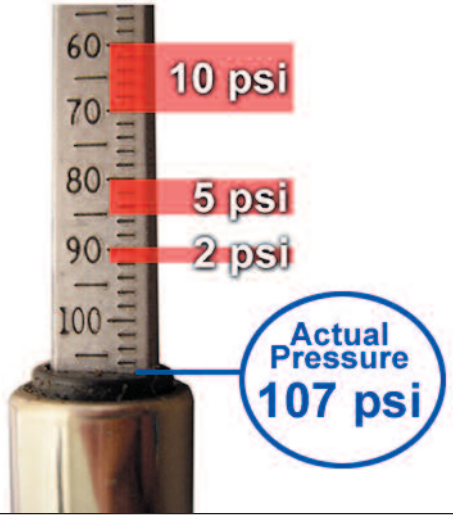
WHEEL DIAMETER 22.5"	PSI	75	80	85	90	95	100	105	110	115	120	MAXIMUM LOAD AND PRESSURE ON SIDEWALL	
	kPa	520	550	590	620	660	690	720	760	790	830		
445/50R22.5 LRL **X One XRV**	LBS SINGLE	7000	7370	7740	8100	8460	8820	9170	9510	9860	10200	S	10200 LBS AT 120 PSI
	KG SINGLE	3180	3330	3520	3660	3850	3990	4130	4310	4450	4625	S	4625 KG AT 830 kPa

How to properly measure pressure

The first step in properly measuring your MICHELIN® X One® tires is to have an accurate pressure gauge. Pressure gauges should be checked weekly against a master calibrated pressure gauge. *Tire Billy's and Thumpers are not considered accurate tire gauges!*

Sometimes, reading the gauge can present difficulties if personnel are not properly trained. Spend the time to explain to your personnel the increments on the gauge and how to properly read pressure. It is highly recommended that you use a real tire and let the trainee take the pressure and tell you what it reads.

Proper air pressure maintenance is critical to obtain optimized performance from your MICHELIN® X One® tires. As part of your pre-trip inspection, it is recommended that you check your MICHELIN® X One® tires daily with an accurate tire pressure gauge.



Check all tires when cold; at least 3 hours after the vehicle has stopped. Never bleed air from hot tires.

Underinflation can lead to:

- Adverse handling conditions
- Zipper ruptures
- Casing fatigue and degeneration
- Irregular wear
- Decreased tread life
- Reduced fuel economy

Overinflation can lead to:

- Adverse handling conditions
- Reduced resistance to impacts and penetrations
- Increased stopping distances
- Irregular wear
- Decreased tread life

THE USE OF NITROGEN IN MICHELIN® TRUCK TIRES

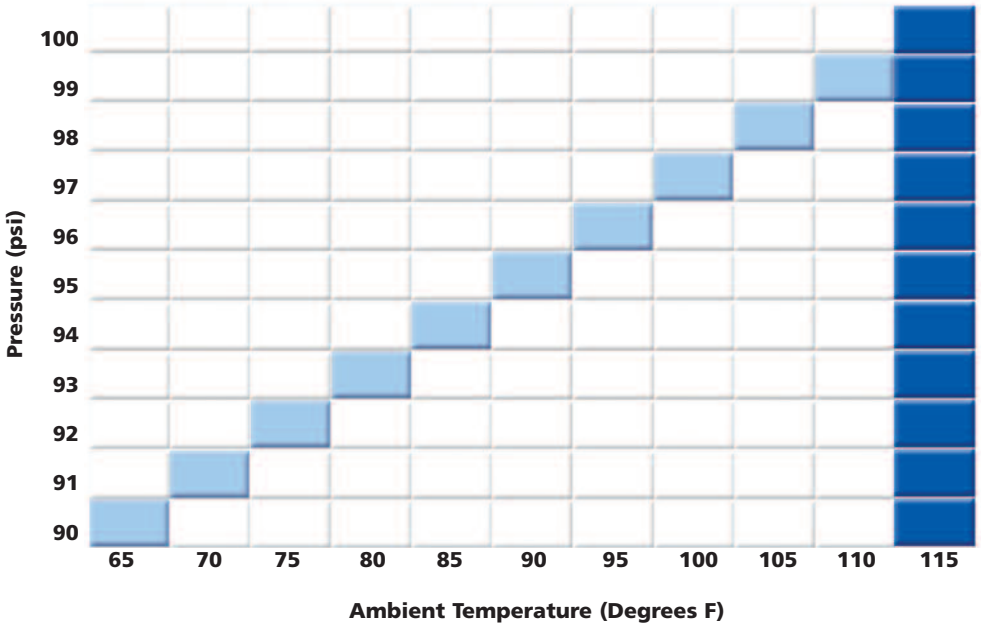
Nitrogen is an inert gas and will not adversely affect the inner liner of the tires nor will it adversely affect the performance of the tires under normal operating conditions.

Therefore, the use of nitrogen in MICHELIN® Truck Tires will not affect the warranty associated with the tires.

Please refer to the MICHELIN Truck Tire Warranty Manual (MWE40021) for what is and is not covered by the warranty.

TEMPERATURE/PRESSURE RELATIONSHIP GRAPH

This graph displays the reason behind checking your tires when cold. As ambient temperature increases, pressure increases. An increase in ambient and/or operating temperature will result in an increase in tire pressure. Checking your tires when hot will result in an elevated reading. A good field thumb-rule to use is that for every 10-degree F increase in temperature above 65, the tire's pressure will increase 2 psi.



RUN-FLAT AND ZIPPER RUPTURES

Run-flat: Any tire that is known or suspected to have run at 80% or less of normal operating pressure.

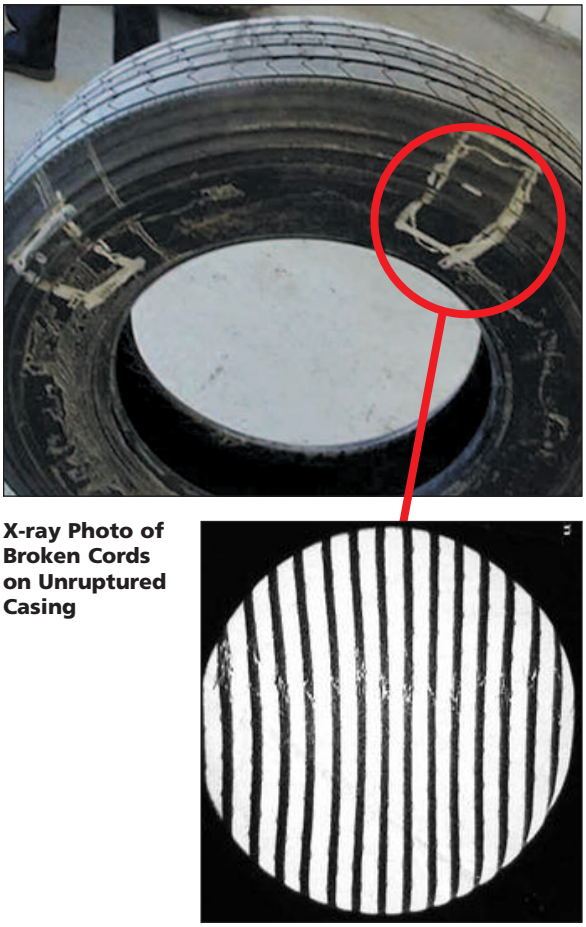
Normal Operating Pressure: The cold inflation pressure required to support a given load as recommended by the tire manufacturer's data book.

Zipper Rupture: This condition is a circumferential rupture in the flex zone of the sidewall. This damage is associated with underinflation and/or overloading. Any moisture that is permitted to reach ply cords will cause corrosion, which can also result in a zipper rupture.

Circumferential Rupture of Casing Ply or "Zipper Rupture"

Occasionally, a tire will be flat when it arrives at the repair facility and there will be no external signs of a rupture. Note the X-ray photo below on the right reveals the broken casing ply cords.

If re-inflated, this tire will experience a rapid loss of air with explosive force. **Zipper ruptures can and have resulted in serious injuries and death!**



X-ray Photo of Broken Cords on Unruptured Casing

You should always use an accurate pressure gauge to determine the pressure inside the tire. Running the MICHELIN® X One® tire helps provide an additional visual identification of significantly underinflated tires. Compare the difference between the MICHELIN® X One® tire at 30 psi and the inside dual at 30 psi.

Since many fleets run pressures higher than the recommended values in the manufacturer's data book, it can be confusing as to when a tire should be considered run-flat. A conservative approach would be to use 80% of the fleet's operating pressure as described in the table below.

Fleet Pressure	Run-flat (80%)
130	104
125	100
120	96
115	92
110	88
105	84
100	80
95	76
90	72

MICHELIN® X One® Tire at 30 PSI

Inside Dual (left) at 85 PSI and Outside Dual (right) at 30 PSI

WARNING

Permanent tire damage due to underinflation and/or overloading cannot always be detected. Any tire that is known or suspected to have been run at 80% or less of normal operating pressure and/or overloaded could possibly have permanent structural damage (steel cord fatigue). Ply cords weakened by underinflation and/or overloading may break one after another, until a rupture occurs in the upper sidewall with accompanying instantaneous air loss and explosive force. This can result in serious injury or death.

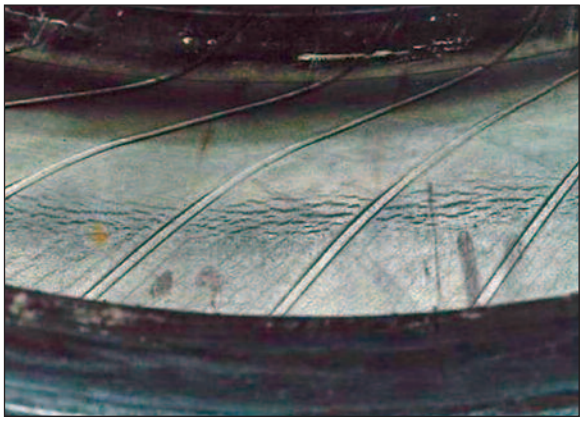
TIRE INSPECTION

Any tire that is determined or suspected to be run-flat, should be inspected thoroughly prior to returning to service.

Look for wrinkling, discoloration, cracking, and/or degradation of the inner liner. Any breach to the inner liner can result in the introduction of moisture to the casing and subsequent corrosion. If any signs of run-flat exist to the inner liner, the tire should be made unusable and scrapped.

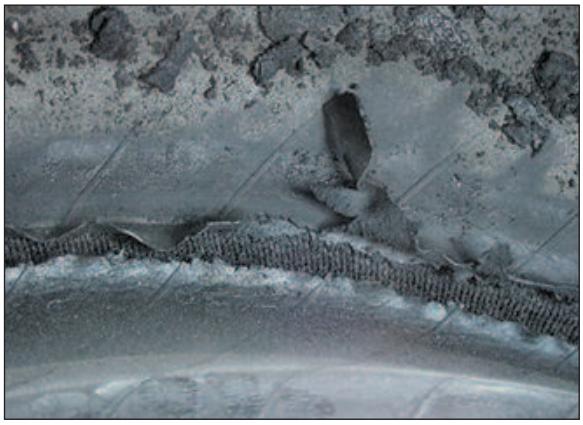
Abrasion marks on the sidewall due to road contact and/or creases in the sidewall are another indicator of run-flat. Feel for soft spots in the sidewall flex area. Using an indirect light source helps identify sidewall irregularities by producing shadows at the ripples and bulges. Look for protruding wire filaments indicating broken sidewall cords.

All patches should be inspected for lifting, cracks, splits, and general condition.

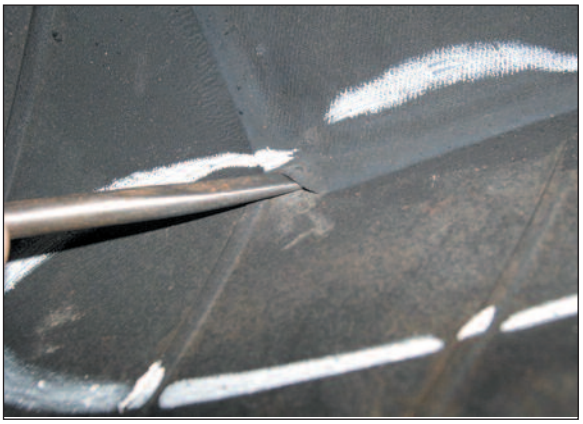


Potential Zipper Rupture

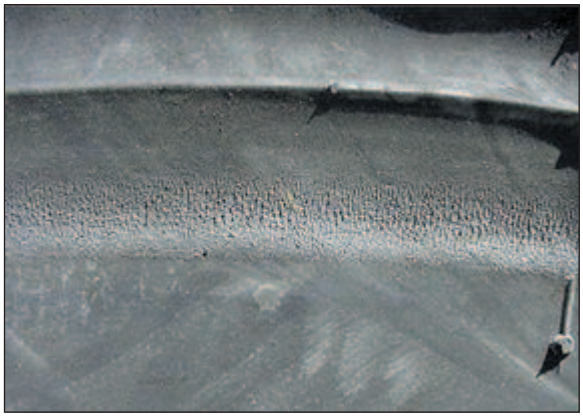
Ripples or Bulges in the Sidewall Flex Area



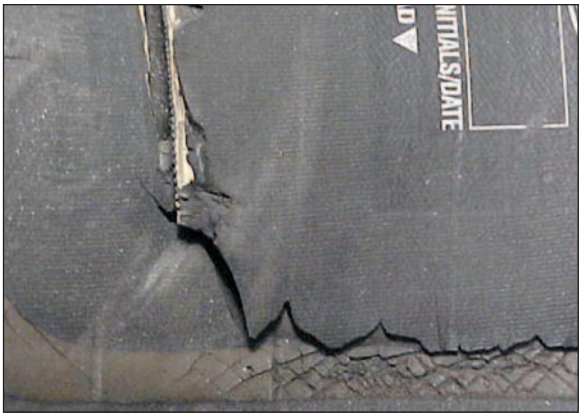
Inner Liner Damages



Patch Lifting

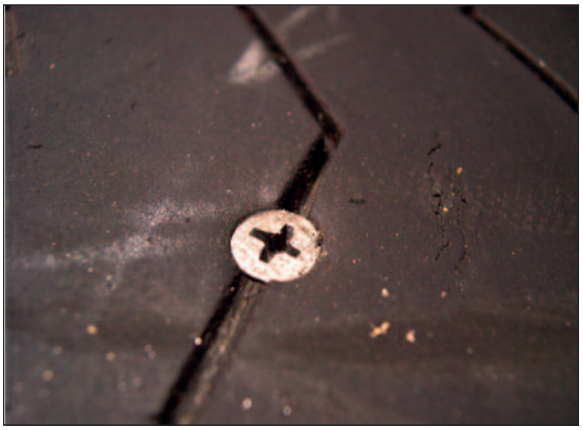


Abrasion Marks on the Sidewall



Patch Cracking

Remove and repair all penetrating objects and check the beads for damage that may have occurred during removal.



Penetrating Objects

Bead Damage Caused by Mounting/Dismounting

If none of these conditions exist, the Rubber Manufacturers Association (RMA) suggests the following procedure for returning the tire to service.

1) Place the tire/wheel assembly in an approved inflation safety cage*. Remain outside of the tire's trajectory. Do not place hands in the safety cage while inspecting the tire or place head close to the safety cage. After properly seating the beads, with the valve core removed, adjust the tire to 20 psi, using a clip-on air chuck with a pressure regulator and an extension hose.

2) Inspect the mounted tire inflated to 20 psi for distortions or undulations (ripples and/or bulges). Listen for popping sounds.
IF ANY OF THESE CONDITIONS ARE PRESENT, THE TIRE SHOULD BE MADE UNUSABLE AND SCRAPPED.
If none of these conditions are present, proceed to the next step.

3) With the valve core still removed, inflate the tire to 20 psi over the normal recommended operating pressure. During this step, if any of above conditions appear, **immediately stop inflation. DO NOT EXCEED MAXIMUM PRESSURE SPECIFICATION FOR THE WHEEL.**

4) Before removing the tire/wheel assembly from the safety cage, reduce the inflation pressure to the recommended normal operating pressure. Remain outside of the tire's trajectory zone.

* *Occupational Safety and Health Administration Standard 1910.177 requires all tubeless and tube-type medium and large truck tires be inflated using a restraining device or barrier (e.g., safety cage that conforms to OSHA standards), and using a clip-on chuck with a pressure regulator and an extension hose.*

MICHELIN® X ONE® TIRES LOAD AND INFLATION TABLES

To determine the proper load/inflation table, always refer to the markings on the sidewall for maximum load at cold pressure. Contact your MICHELIN dealer for tires with maximum loads and pressures other than indicated here.

Load and inflation industry standards are in a constant state of change. Michelin continually updates its product information to reflect these changes. Therefore, printed material may not reflect the current load and inflation information.

NOTE: Never exceed the wheel manufacturer's maximum air pressure limitation.

S = Single configuration - 2 tires per axle

WHEEL DIAMETER 22.5"	PSI	75	80	85	90	95	100	105	110	115	120	125	130	MAXIMUM LOAD AND PRESSURE ON SIDEWALL	
	kPa	520	550	590	620	660	690	720	760	790	830	860	900		
445/50R22.5 LRL **X One XDA,** **X One XDA-HT Plus,** **X One XDN2,** **X One XTA,** **X One XTE**	LBS SINGLE	13880	14620	15360	16060	16780	17480	18180	18740	19560	20400			S	10200 LBS AT 120 PSI
	KG SINGLE	6300	6640	6960	7280	7620	7940	8240	8500	8860	9250			S	4625 KG AT 830 kPa
455/55R22.5 LRL **X One XDA-HT Plus,** **X One XDN2,** **X One XTE** ❀	LBS SINGLE	15000	15800	16580	17360	18120	18880	19640	20400	21200	22000			S	11000 LBS AT 120 PSI
	KG SINGLE	6800	7160	7520	7880	8220	8560	8900	9250	9580	10000			S	5000 KG AT 830 kPa
455/55R22.5 LRM **X One XZU S,** **X One XZY3**	LBS SINGLE			16580	17360	18120	18880	19640	20400	21200	22000	22600	23400	S	11700 LBS AT 130 PSI
	KG SINGLE			7520	7880	8220	8560	8900	9250	9580	10000	10240	10600	S	5300 KG AT 900 kPa

❀ With chip and cut resistant tread compound.

TECHNICAL SPECIFICATIONS FOR MICHELIN 455/55R22.5 LRM WITH 13.00 x 22.5 WHEELS STEER AXLE, FIRST LIFE ONLY

Dimension	Load Range	Loaded Radius		Revs Per Mile	Max Load Single*			
		in.	mm		lbs.	psi	kg.	kPa
455/55R22.5 **13" rim**	LRM	19.5	496	493	10000	120	4535	830

psi	75	80	85	90	95	100	105	110	115	120
kPa	520	550	590	620	660	690	720	760	790	830
lbs. per axle	13740	14460	15180	15880	16600	17280	17980	18660	19340	20000
kg. per axle	6240	6520	6900	7180	7560	7820	8100	8460	8720	9070

* **NOTE:** When used on a 13.00" rim the max load and pressure is lower than that indicated on the sidewall.

MICHELIN INFLATION CHARTS FOR RV USAGE ONLY

In the load and inflation tables, SINGLE means an axle with one tire mounted on each end, while DUAL means an axle with two tires mounted on each end. In an RV application, the loads indicated represent the total weight of an axle end. When one axle end weighs more than the other, use the heaviest of the two end weights to determine the unique tire pressure for all tires on the axle. The maximum cold air pressure for each axle may vary, depending on their weights. This table is applicable for all RV axles, whether or not they are power-driven.

WHEEL DIAMETER 22.5"	PSI	75	80	85	90	95	100	105	110	115	120	MAXIMUM LOAD AND PRESSURE ON SIDEWALL	
	kPa	520	550	590	620	660	690	720	760	790	830		
445/50R22.5 LRL **X One XRV**	LBS SINGLE	7000	7370	7740	8100	8460	8820	9170	9510	9860	10200	S	10200 LBS AT 120 PSI
	KG SINGLE	3180	3330	3520	3660	3850	3990	4130	4310	4450	4625	S	4625 KG AT 830 kPa

IRREGULAR TIRE WEAR

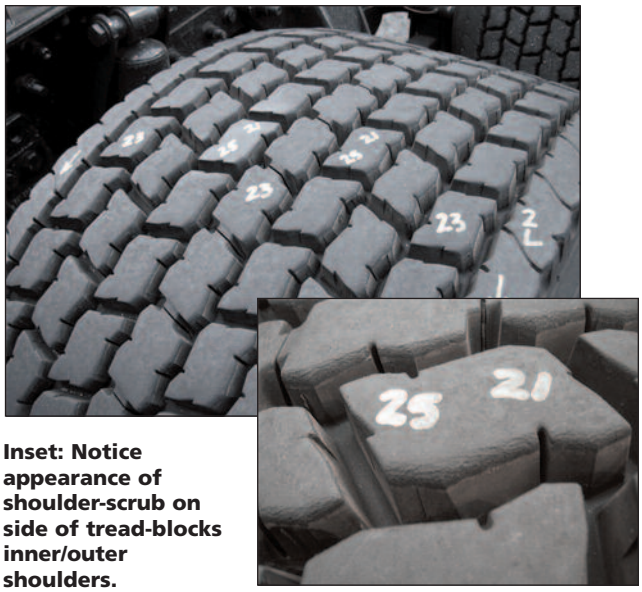
TRACTOR:

Heel-Toe
(Condition Code 182)

Appearance:
Drive-lugs around the tire worn high to low from the front to back edge on tread of tire.

Probable Cause:
High torque, pickup and delivery operations (P&D) plus mountainous terrain, high braking operations.

Analysis/Correction:
Drive tires should be rotated, front to rear; cross rotation is permitted, but will accelerate wear and can reduce removal mileages. With the MICHELIN® X One® tire, since you have no dual pressure differences, heel and toe pattern should clear itself up @ 1/3 worn.



Inset: Notice appearance of shoulder-scrub on side of tread-blocks inner/outer shoulders.

Center Wear
(Condition Code 186)

Appearance:
Tire wears more rapidly in the center of the tread, than in the shoulders.

Probable Cause:
LTL (Less than Truckload) operation + high torque, incorrect air pressure.

Analysis/Correction:
Five tread depths should be taken in the drive position, allowing one to recognize wear conditions.
Correction of drive-axle air pressure will reduce the wear pattern and enhance tire mileage.

River Wear Only
(Condition Code 188)

Appearance:
Tire exhibits circumferential wear along the rib-edges next to the major shoulder tread-ribs.

Probable Cause:
Characteristic of slow wear-rate of radial tires.

Analysis/Correction:
None, river wear should not be of concern.

TRAILER:

Step-Shoulder/Localized Wear Shoulder Cupping (Condition Code 187/196)

Left Front Trailer Position (Original)

Left Front Trailer Position (Rotated)

Appearance:
Tire exhibits step-down wear on one or both shoulders or localized cupped out areas.

Probable Cause:
Damaged/bent trailer-axle, incorrect camber setting, alignment issue, LTL (Less than Truckload) operation, incorrect air pressure, suspension compliance.

Analysis/Correction:
Review tire application with tire manufacturer; review inflation maintenance procedures.
Check trailer alignment for bent or worn parts, or consult trailer OE.

Trailer Rotation:
Irregular wear on the inside shoulder of trailer tires can be rectified by flipping the tire on the wheel, where the inner shoulder becomes the outside shoulder. Criss-cross rotation may also be helpful depending upon 1st and 2nd trailer axle wear-rates.

Brake Skid (Condition Code 176)

Appearance:
A tire with brake drag is characterized by localized abrasion or flat spot if severe. If left in service, it may continue to grow across the face of the tread.

Probable Cause:
Tractor/trailer moved prior to system air pressure building up sufficiently to release parking brakes: resulting in dragging the tires or driver over-using hand or trailer brake.

Analysis/Correction:
Review driver tractor/trailer hook-up and departure instructions. The fleet yard mule driver can be a factor. If they are in a hurry to move trailers, they may pull away before the air pressure has built up sufficiently to release the brakes. If the flat spotting is minor, leave the tire in service. If tire induces vibration, has exposed steel or is lower than the minimum required tread depth, remove the tire from service. Even vehicles equipped with anti-lock brake systems (ABS) can experience flat spotting, depending on the number and placement of sensors and modulators used.

ALIGNMENT AND VIBRATION

INTRODUCTION

In order to maximize tire life, the MICHELIN® X One® tire-equipped truck needs to be maintained just like its dual equipped counterpart. Due to the complexity of today's trucks, this can be an overwhelming task. By addressing the primary causes of the most common tire wear issues, we can simplify this process. The following 4-step approach attacks the major sources of tire wear, alignment wear, and vibration.

1. **Air Pressure:**
   #1 cause of irregular wear issues (Pages 45-46).
2. **Toe:**
   #1 cause of alignment-related wear issues.
3. **Axle Skew:**
   #2 cause of alignment-related wear issues.
4. **Radial and Lateral Runout:**
   #1 cause of vibration-related issues.

All 4 steps can be performed at the fleet level and require a minimal investment for tools and training.

For more detailed information on alignment, refer to *TMC RP 642A, Total Vehicle Alignment: Recommendations for Maximizing Tire and Alignment-Related Component Life*. For more detailed information on runout and balance, refer to *TMC RP 214C, Tire/Wheel End Balance and Runout.*

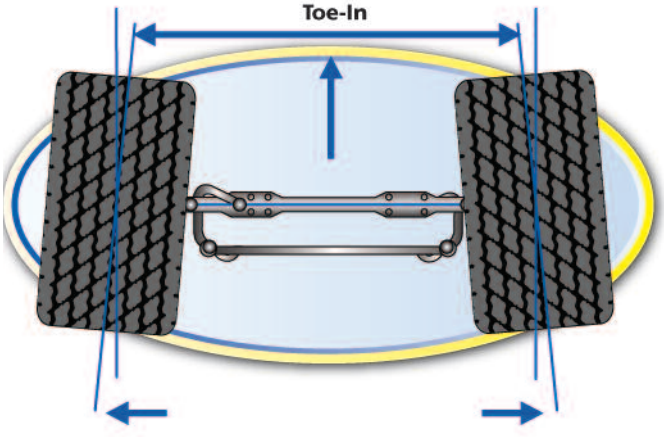
TOE

Toe is the #1 cause of alignment-related tire wear generally affecting the steer position. It is also a parameter that can be checked and adjusted easily in a shop environment. With the vehicle jacked up and using a toe scribe, you can mark a line around the circumference of the left steer tire and repeat the procedure to the right steer tire. Then letting the truck down on a frictionless surface (a folded plastic bag), you can then measure between those two lines at the same height on both sides. You can use two equal-sized objects as a reference. The closer you are to hub height, the more accurate your measurement will be.

Ideally, you want the rear measurement to be bigger by 1⁄16" or 1.5 mm. If it is not, you should adjust the toe by loosening the cross tube clamps and turning the cross tube to either lengthen or shorten the overall assembly. Remember to re-tighten the clamps and recheck your measurement following the adjustment.

Specification: 1⁄16" Toe In or "Positive Toe." Note that there is no tolerance or "slop" for this setting.

Tools Required: Toe scribe, tape measure, spray paint, and plastic trash bags.



(Distance Between Rear of Tires) – (Distance Between Front of Tires) = Total Toe

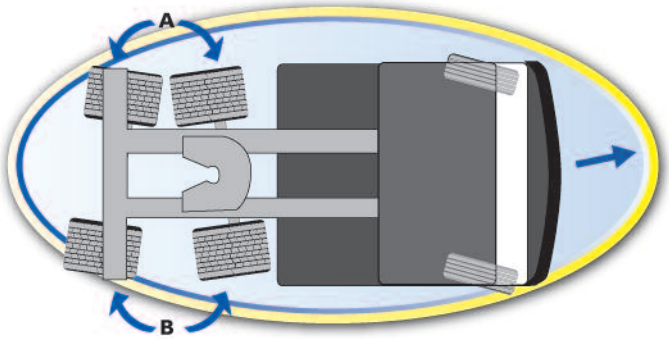
If the value is a negative number (rear measurement less than the front), then you have Toe Out.

If the value is a positive number (front measurement less than rear), then you have Toe In.

AXLE SKEW

Axle skew is the #2 cause of alignment-related wear and affects steer, drive, and trailer tires. It is sometimes referred to as scrub or axle parallelism. When drive axles are not parallel to each other, it has a negative effect on all tractor tires. This is due to the vehicle wanting to pull in the direction where the axle ends are closest together.

This forces the driver to counter-steer in the opposite direction. This usually results in feathering of the steer tires in opposite directions. In other words, one exhibits toe in and the other exhibits toe out. If this condition is felt on your steer tires, it is usually a classic symptom of your rear drive axles not being parallel with each other. By using a trammel bar, you can quickly and easily determine if your tractor has a skew problem.



Trammel Bar

Specification: < 1⁄8" difference between axle ends.

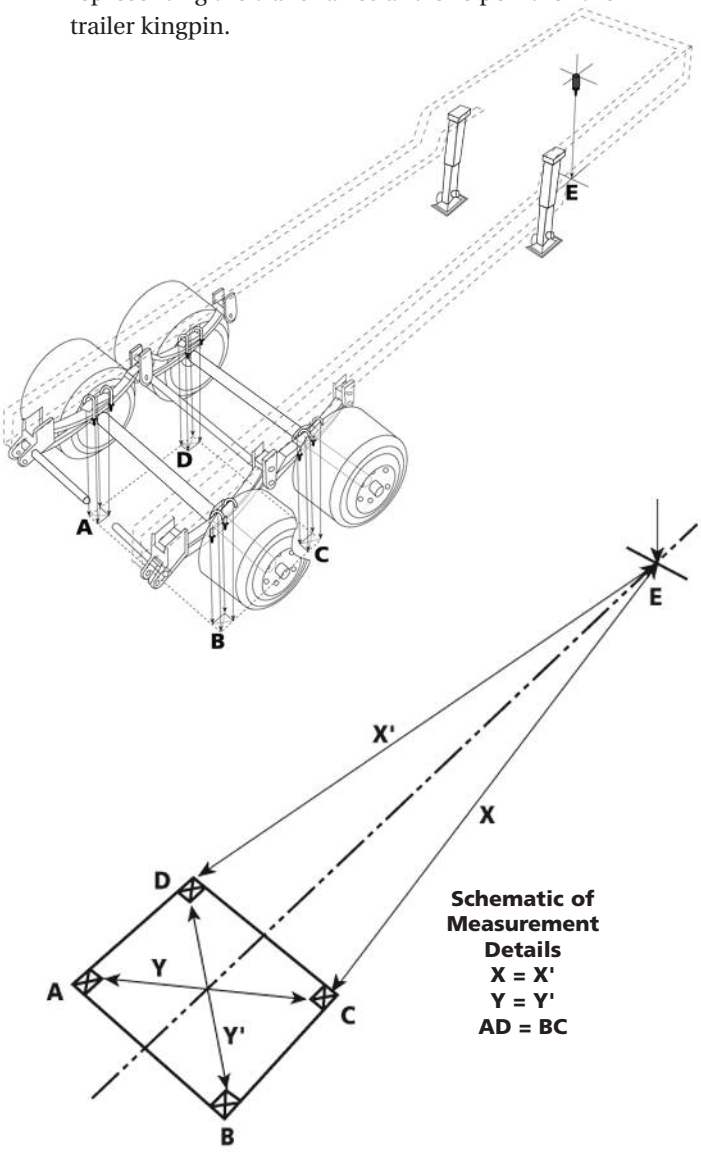
Tools Required: Trammel bar and tape measure (if scale not present on trammel bar)

TRAILER ALIGNMENT

Trailers should not be overlooked when investigating alignment-related tire wear issues. Misaligned trailers usually result in rapid and/or irregular trailer wear, poor tracking, and steer tire wear due to the driver counter-steering to keep the trailer in the lane.

This driver has to constantly counter-steer to the left to keep the trailer off the shoulder.

Using a plumb bob and string, select two points on the front axle and two on the rear axle that are equal from the center of the trailer chassis. Usually, the point where the springs/air bags mount to the axle makes a good reference point. On a flat, level surface, mark four points on the ground representing the trailer axles and one point for the trailer kingpin.



Schematic of Measurement Details
X = X'
Y = Y'
AD = BC

Ideally, you want DE = CE and AD = BC.
This would indicate your axles are not only parallel but square with the kingpin.

Specifications:
Difference between axle ends
< 1⁄16" (AD compared to BC)
Difference between kingpin to axle measurements
< 1⁄8" (DE compared to CE)

Tools Required: Plumb bob and string, 100 ft. tape measure.

VIBRATION

Tire-induced vibrations are generally the result of out-of-round assemblies. Common causes for out-of-round assemblies are components such as wheels, drums, and hubs and are corrected by changing the individual component. The most common cause stems from mismount or improper mounting procedures that lead to the tire not seating concentrically with the wheel. Whether it's an individual component part or a mounting issue, these problems can be identified easily by checking for radial and lateral runout.

Radial Runout

NOTE: A piece of duct tape wrapped around the tread will facilitate measuring radial runout on block style drive tread designs.

Lateral Runout

Specifications for MICHELIN® X One® tires: See *TMC RP 214C, Tire/Wheel End Balance and Runout* for more details on radial and lateral runout readings.

Radial Runout < .095"
Lateral Runout < .095"

14" x 22.5 Aluminum Wheels < .030"
14" x 22.5 Steel Wheels < .070"

Tools Required: Truck style runout gauge stand with dial indicator.

BALANCE

The Technology Maintenance Council (TMC) has specifications for balancing.

Specifications for X One® tires: See *TMC RP 214C, Tire/Wheel End Balance and Runout, Appendix B* for more details on balance.

Steer: 24 oz.
Drive: 28 oz
Trailer: 28 oz

Tools Required: A static or dynamic wheel balancer and adapters to accommodate the larger MICHELIN® X One® tire and wheel assembly.

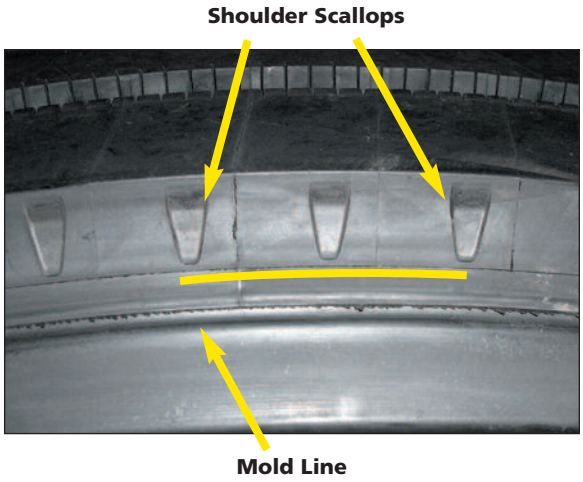
When troubleshooting a ride disturbance, it is standard practice to check the balance. Due to the major impact runout has on balance, we recommend that you always check radial and lateral runout prior to attempting to balance the assembly.

Tread Depth Pull Points

When setting a fleet standard for tread depth pull points, there is more to consider than just the legal DOT (Department of Transportation) minimum tread depths of 4⁄32" steer and 2⁄32" drive and trailer.

Most fleets who retread, or even sell their casings to dealers or other fleets who do retread, will generally choose a tread depth of 5⁄32" or greater to help ensure that the casing has the best chance of passing inspection. One reason they choose this higher than legal minimum depth is that they know that even if they set it at 5⁄32" there will be some tires that slip through, and may not be removed until 2⁄32" or 3⁄32" later. In other words, if a tire that should be pulled for fleet spec of 5⁄32" stays in service a little longer, it won't be as big an issue as the tire that was supposed to be pulled at 3⁄32" and continued to stay in service for an additional 2⁄32" of wear. It is a good safety net for ensuring you meet DOT minimum requirements, and also for the casing that becomes more susceptible to stone drilling, penetrations or cuts.

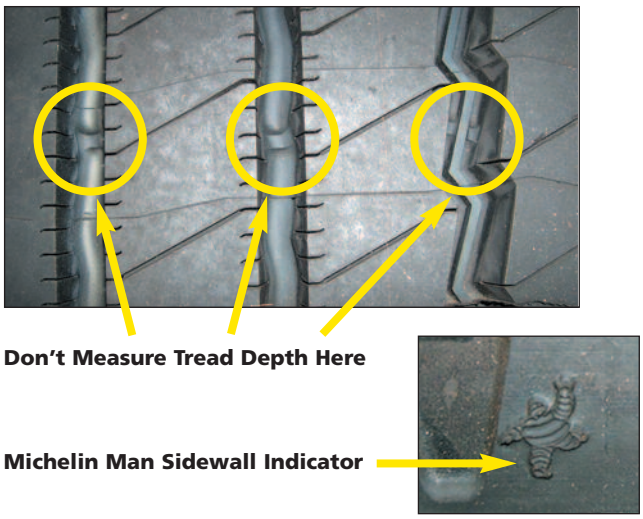
Additionally, there are also some visual clues that are molded into every MICHELIN® X One® tire to alert you to pull points.



All MICHELIN® X One® tires have built-in "scallops" or small indentations right on the shoulder edge. The bottom of this scallop corresponds with the normal wearing surface of the tread. Therefore, when you wear down to the bottom of this indentation, it is time to remove the tire for retreading.

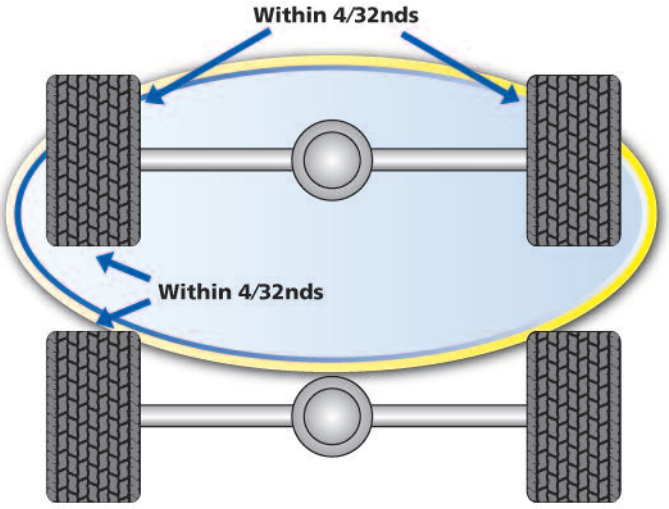
Additionally, there is a circumferential raised line just below the bottom of the scallops. This is where the tread mold meets the sidewall mold, and the rule of thumb if using this indicator as a reference is to pull the tire when the wear reaches 1⁄4" ABOVE this line.

Also, there are 2⁄32" wear bars molded into the tread on all MICHELIN® X One® tires. When these become level with the tread, they are visual indicators that it is legally time to pull a drive or trailer tire. Care should be taken to not take tread depth measurements at the wear bars. Their placement is indicated on the sidewall/shoulder by a miniature Michelin Man.



In order to fight irregular and fast wear, traditional dual tires need to be matched within 4⁄32" tread depth or 1⁄4" in diameter and within 10 psi. MICHELIN® X One® tires remove this extra maintenance burden. However, all tires (dual or wide single) should be within 4⁄32" intra-axle (across the axle) and inter-axle (axle to axle groupings) for proper engine and braking functions and to reduce wear and tear on axle differentials.

Finally, some fleets find that it may be better to pull drive tires at around 10⁄32" and move to a trailer position. If you are running in mud, snow, or other low traction situations, this may be a great way to address traction concerns. Experience shows that worn drive tires perform exceedingly well in trailer positions.



CARE, CLEANING, AND STORAGE

DIESEL FUEL CONTAMINATION

Diesel fuel and other petroleum-based products can cause blistering, swelling, or a spongy condition. Swelling is typically seen in the tread, and blistering is typically seen on the sidewall. The odor of the petroleum-based product may be evident. The rubber will also be softer than another part of the tire with no petrol damage. Generally it may be 30-40 points softer on the shore hardness gauge.

If these conditions are seen or experienced, scrap the tire.

Swellings in the Tread

Sidewall Contamination

CLEANING AND PROTECTION

Soap and water is the best solution to cleaning tires. If you use a dressing product to "protect" your tires from aging, use extra care and caution. Tire dressings that contain petroleum products, alcohol, or silicone will cause deterioration and/or cracking and accelerate the aging process. Be sure to refer to the protectant or dressing label contents to confirm that none of these harmful chemicals are present.

In many cases, it is not the dressing itself that can be a problem, but rather the chemical reaction that the product can have with the antioxidant in the tire. Heat can make this problem worse. When these same dressing products are used on a passenger car tire that is replaced every 3 to 4 years, it is rare to see a major problem. In many cases, truck tires may last much longer due to higher mileage yields and subsequent retread lives, and the chemical reaction takes place over a longer period.

SEALANTS

THE USE OF SEALANTS IN MICHELIN TRUCK TIRES

The use of sealants in MICHELIN Truck Tires does not affect the tire warranty unless it is determined that the sealant has adversely affected the inner liner or the performance of the tires.

Prior to using any type of sealant, Michelin strongly recommends that the customer make sure the sealant has been tested and certified by the sealant manufacturer as being safe for use in tires.

Please consult Michelin prior to using sealants in any MICHELIN tires that have sensors in them. The sealant may adversely affect the performance of the sensors.

Michelin has jointly tested a "non-aqueous" sealant for use in its regional, urban, sanitation, and on/off road tires. It was determined that the sealant was both safe and effective in helping to reduce air loss as a result of punctures.

"Non-aqueous" means the sealant contains little or no water. Actual sealant testing using the Karl Fisher Method (ASTM 6304, weight percent) indicated a water content of less than 3%. Since the sealant is "non-aqueous," it does not promote the oxidation (rusting) of the steel cables when a puncture does occur.

In order to remain "water free," it is important that once the container is opened during usage, it is resealed after use and stored in an air-conditioned space if possible. This will prevent the absorption of moisture from the atmosphere.

VALVE STEM INSPECTION

LOOSE AND LEAKY VALVE STEMS

Whether they are new or have been in use over a period of time, valve stems can become loose. It is recommended that you verify torque on all wheels put into service. When installed, they should be torqued, using the proper tool at 80 to 125 in/lbs (7 to 11 ft/lbs) for aluminum wheels and 35 to 55 in/lbs (3 to 5 ft/lbs) for steel wheels.

Checking for loose and leaky valve stems should be made a part of your regular maintenance schedule.

Methods for checking for loose valve stems:
- check with a torque wrench
- check by hand to see if the valve nut is loose
- spray a soapy solution on the valve to see if there is a leak

Corrosion-Related Leak

Retread and Repair Recommendations

MICHELIN® X ONE® RETREAD AND REPAIR RECOMMENDATIONS 54-55

- Initial Inspection
- Shearography
- Buffing
- Tread Building
- Enveloping
- Curing
- Final Inspection

REPAIR RECOMMENDATIONS 56

RETREAD RECOMMENDATIONS 56

MICHELIN® X ONE® RETREAD AND REPAIR RECOMMENDATIONS

While the MICHELIN® X One® tire may require some special equipment to handle the wider tread and casing, it does not require any special procedure to be repaired or retreaded. As with any tire, special care should be given to respect the recommendations and guidelines associated with the specific product to ensure optimum performance.

INITIAL INSPECTION

Inspect the MICHELIN® X One® casings as defined by your retread process manufacturer or industry recommended practices using appropriate equipment.

When using an electronic liner inspection device, such as the Hawkinson NDT, a new wide base probe of at least 275 mm/10.9 inches is required to insure sufficient and consistent cable contact with the shoulder/upper sidewall area. (Hawkinson part # PROBE ASSEMBLY 009). It is recommended to slow the rotation speed or make several additional cycles to catch as many small punctures as possible.

SHEAROGRAPHY

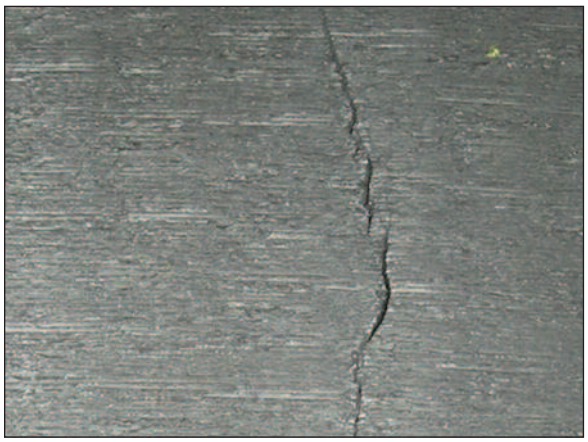
If using laser shearography inspection, adjust and/or modify to insure complete imaging shoulder to shoulder, per equipment manufacturer. Also make sure the correct vacuum level is applied.

BUFFING

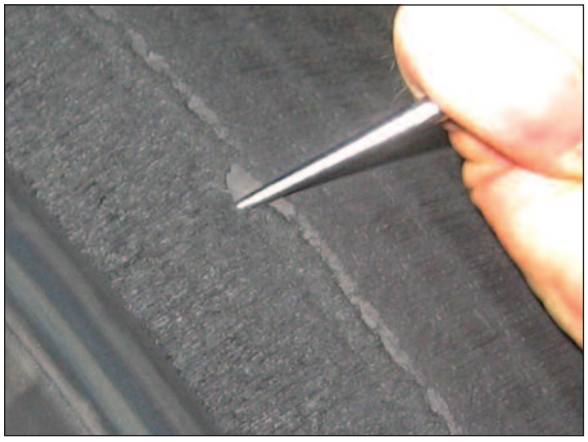
An expandable rim width of 14.5 inches is required. The beads of the casing should be lubricated with a fast drying non-petroleum based tire lubricant. Buffing should not start before casing reaches target pressure in the expandable rim as defined by your retread process manufacturer. Recommended minimum inflation pressure is 1.2 bars or 18 psi. Recommended tread width ranges are given below and may vary depending on the type and condition of the MICHELIN® X One® casing. The MICHELIN® X One® casing's finished, buffed measured width should follow the same standards as other casings: no more than 2 mm less than the tread width and no more than 8 mm more than tread width.

AFTER BUFF INSPECTION

If after buffing, multiple circumferential cracks or splits remain in one or both shoulders of the tire in the vicinity of the outside tread groove (Picture 1), the casing should be rejected. This should not be confused with a 360 degree product interface line that sometimes is visible after buff (Picture 2). If this line is visible, it should be probed; and if found to be loose material, the casing should be rejected. If it is tight, continue the retread process.



Picture 1



Picture 2

TREAD BUILDING

Expandable rim width of 14.5 inches is required. Buffing on a more narrow rim can result in excess undertread remaining in the shoulder, increasing the operating belt edge temperature.

Tread building should not begin until tire pressure has reached the target inflation pressures in the expandable rim as defined by your retread process manufacturer.

For cushion to casing extruded bonding gum application, recommended minimum inflation pressure is 0.8 bar or 12 psi. Bonding gum thickness should not exceed 1.5 mm (2/32") in the crown and 2.5 mm (3/32") in the shoulders.

Note: For non-Michelin wing tread products, contact MRT Duncan, SC at 1-888-678-5470, then press 3 for Technical Support.

ENVELOPING

Contact your envelope supplier for the recommended size envelopes to be used.

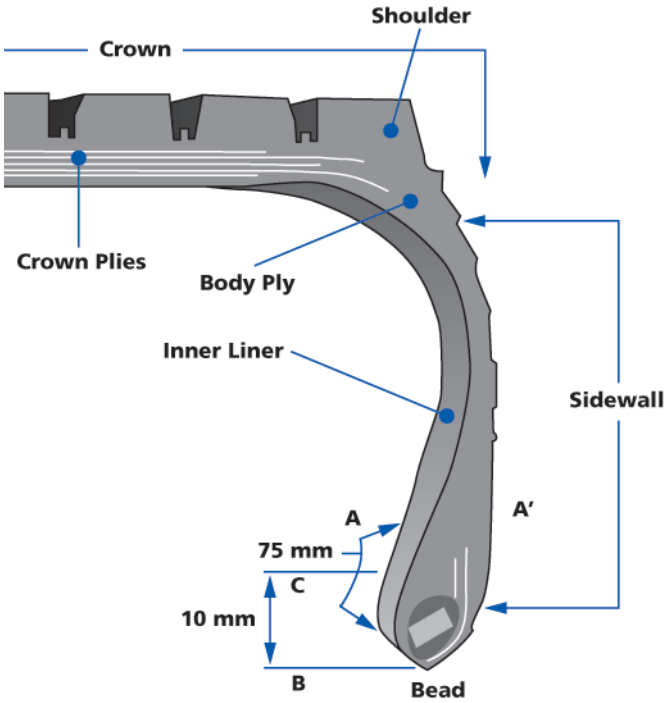
CURING

Cure the MICHELIN® X One® casing according to cure law for the tread design per the retread process manufacturer.

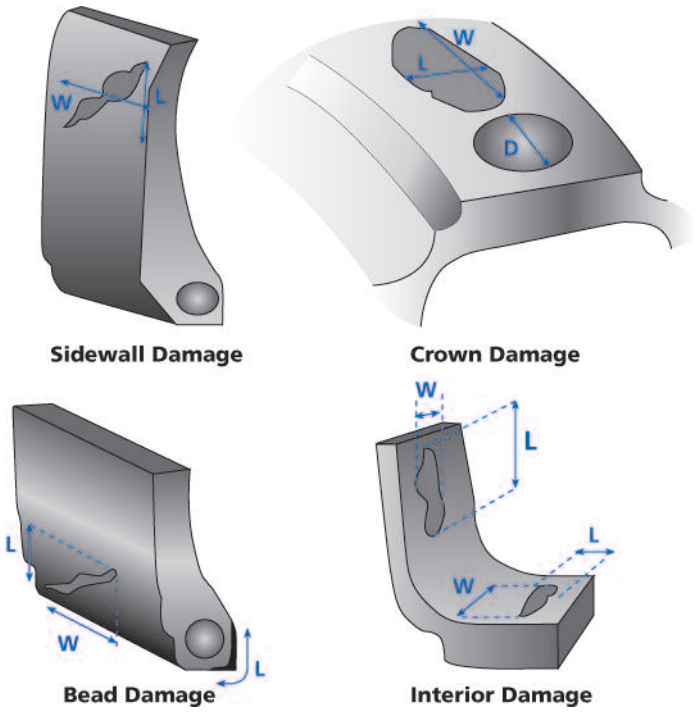
FINAL INSPECTION

Conduct the final inspection of the MICHELIN® X One® casing according to the retread process manufacturer work method and specification.

Note: The retreader is still responsible for determining if the MICHELIN® X One® casing is capable of being retreaded; the same as would be done for any other tire in the inspection process.



NOTE: For truck sizes, point B is located on the point of the bead, point A is found 75 mm from B towards the interior of the casing, and point A is also 75 mm from B but is located on the exterior of the casing.



REPAIR RECOMMENDATIONS*

Type of Repair	Application	Quantity Limits	Size Limits
Spot Repair (no body ply affected)	Long Haul, Pickup & Delivery (P&D)	Max 10 per sidewall	No limit
	Severe Service	Max 20 per sidewall	No limit
Bead Repairs (rubber damage only)	All	Max 4 per bead	Max width: 150 mm *(6 in)* Min distance between repairs: 75 mm *(3 in)*
	Severe Service (bead toe repair only)	No limit	L = 2 mm x W = 50 mm *(1/16 in x 2 in)* Min distance between repairs: 75 mm *(3 in)*
Bead Repairs (chafer strip)	All	Max 4 per bead	L = 25 mm x W = 55 mm *(1 in x 2 in)* Min distance between repairs: 75 mm *(3 in)*
Liner Repairs	All	No limit	If blister diameter is less than 5 mm *(3/16 in)*, leave intact; repair between 5 mm *(3/16 in)* and 20 mm *(3/4 in)*
			If blister diameter is more than 20 mm *(3/4 in)*, reject casing
Buzzouts (protector ply of 3rd working ply)	Long Haul, P&D	Max 15 per tire	Max diameter: 40 mm *(1.6 in)* Max surface: 1600 mm² *(2.5 in²)*
	Severe Service	Max 60 per tire	Max diameter: 40 mm *(1.6 in)* Max surface: 1600 mm² *(2.5 in²)*
Buzzouts (2nd working ply; Infinicoil)	Long Haul, P&D	Max 3 per tire	Max diameter: 30 mm *(1.2 in)* Max surface: 900 mm² *(1.4 in²)*
	Severe Service	Max 20 per tire	Max diameter: 30 mm *(1.2 in)* Max surface: 900 mm² *(1.4 in²)*
Nail Hole Repairs	All	Max 5 per tire	Max diameter: 10 mm *(0.4 in)*
Section Repairs	All	Max 2 per tire	Crown Max diameter: 25 mm *(1.0 in)*
			Sidewall L 70 mm x W 25 mm *(2.8 in x 1.0 in)* L 90 mm x W 20 mm *(3.8 in x 0.8 in)* L 120 mm x W 15 mm *(4.7 in x 0.6 in)*

RETREAD RECOMMENDATIONS*

Casing Size	Buff Radius	Circumference	Tread Width		
			Tread Type	Min	Max
445/50R22.5	1800 mm *(71 in)*	3070 mm *(121 in)*	Flat Tread	380 mm	390 mm
			Wing Tread**	375/420 mm	385/430 mm
455/55R22.5	1800 mm *(71 in)*	3225 mm *(127 in)*	Flat Tread	390 mm	400 mm
			Wing Tread**	385/430 mm	395/440 mm

* Disclaimer - Documents subject to change.
** For non-MICHELIN wing tread sizes, contact MRT Technical Support at 1-888-678-5470 Option 3.

Operation and Handling

OPERATION AND HANDLING 58-63

Over-steer

Under-steer

Hydroplaning

Rollover Threshold

Jack-knife

Rapid Air Loss Procedure

Traction

Chains

Stopping Distances

Limping Home

State and Local Regulations

HEAT STUDY 64-67

Brake Heat Overview

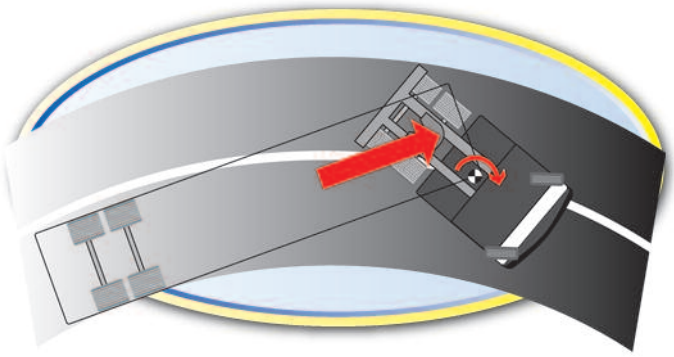
Brake Heat Evaluation: MICHELIN® X One® Tires vs Duals

MICHELIN
A better way forward

OPERATION AND HANDLING

OVER-STEER

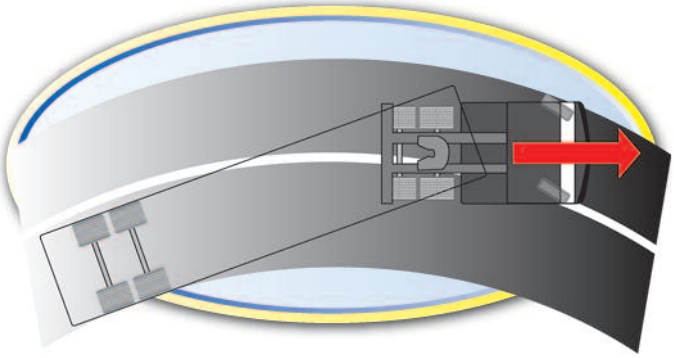
Over-steer is when the rear wheels are carving a larger arc than the front wheels or the intended line of the turn. This is often described as a "loose" condition, as the truck feels like the rear end is coming around.



Over-steer: Very Difficult to Correct

UNDER-STEER

Under-steer is when the front wheels are carving a larger arc than the rear wheels. This is often described as "push" or "pushing," as the front end feels like it is plowing off of a corner.

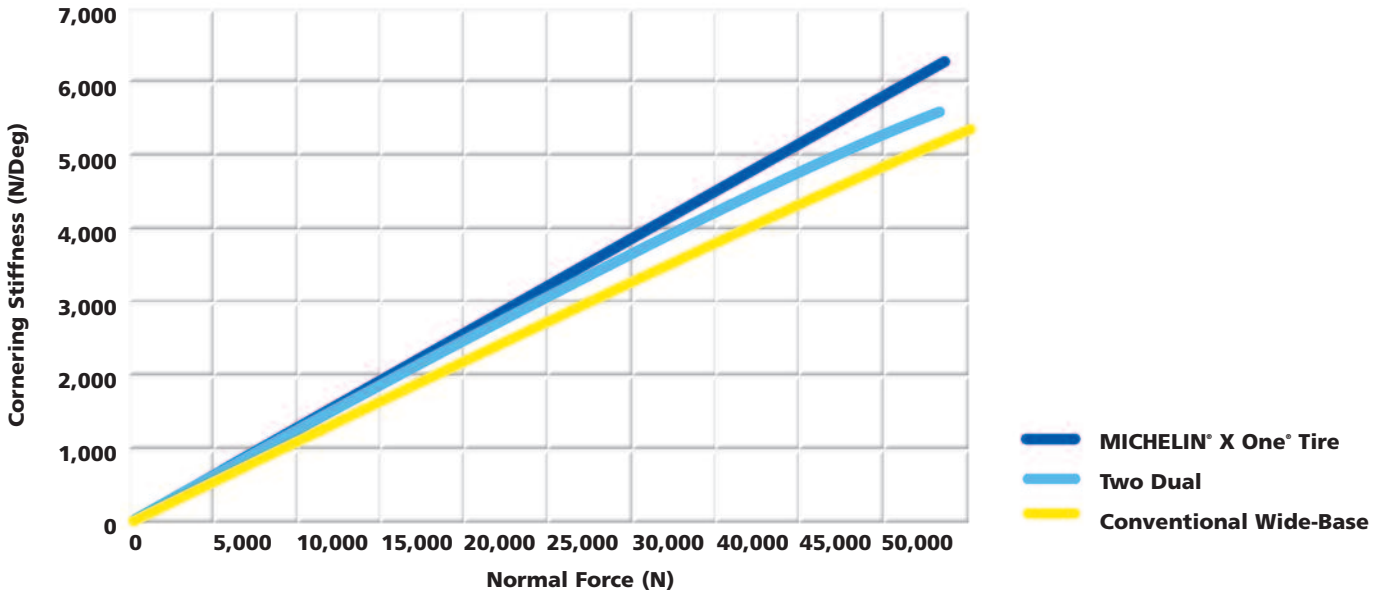


Under-steer: Very Easy to Correct

Over-steer is dangerous because once the rear end comes around, the vehicle is uncontrollable and may enter a spin. Braking only makes this condition worse. Under-steer is the more desirable condition because you have direct control over the front tires, and deceleration usually corrects the condition.

The MICHELIN® X One® tire has a higher cornering stiffness and can generate more lateral force than standard dual drive tires. Increasing cornering stiffness of the rear tires promotes under-steer. Additionally, it will take more force to jack-knife the vehicle.

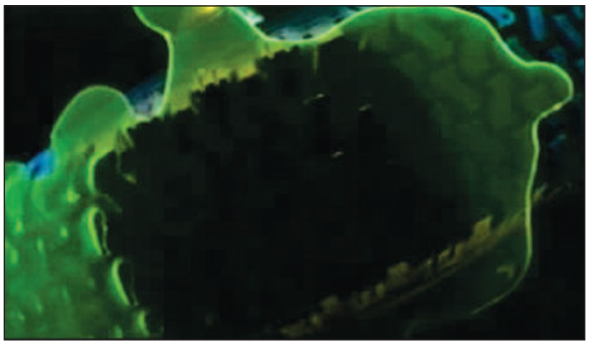
CORNERING STIFFNESS FOR DIFFERENT TIRES



Source: Recent evaluations at a MICHELIN facility in South Carolina.

HYDROPLANING

Hydroplaning occurs when the tire loses contact with the road. This can happen when the water pressure exceeds the contact pressure between the tire and the road.



Factors that increase likelihood of hydroplaning:

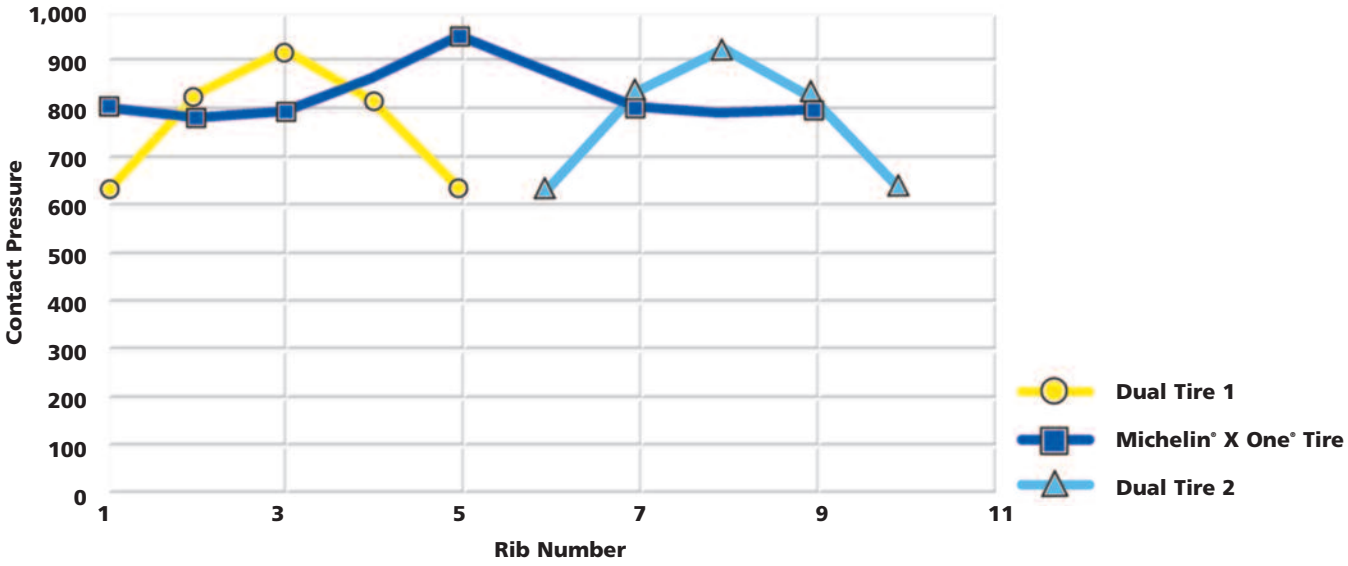
– Excess water
– Excessive speed
– Low tread depth
– High tire pressure
– Light loads or bob-tailing

In other words, if rain is pouring down and water is pooling, the truck's speed needs to decrease in order to avoid hydroplaning.

A tire's contact pressure can reduce your chance of hydroplaning. The MICHELIN® X One® tire has higher contact pressure at the edge of the tread, which provides a wider "sweet spot" than dual tires. In the graph below, you can see that the contact pressure is slightly higher in the center and significantly higher at the shoulders over dual fitments. Note the drop in contact pressure for dual tires on the graph below.

For example, the contact pressure of a dual tire is about 90 psi compared to 116 psi for a MICHELIN® X One® tire. This will result in the dual tire losing contact with the road at lower speed than the MICHELIN® X One® tire. This means if hydroplaning occurs at 60 mph for the MICHELIN® X One® tire, it will occur at 53 mph on the dual.

Contact Pressure Ratio = $\sqrt{90 \div 116}$ = 88%
or
60 mph x 0.88 = 53 mph



Source: Recent evaluations at a MICHELIN facility in South Carolina.

ROLLOVER THRESHOLD

There are two things you can change to make a vehicle more resistant to rollover:

– Lower the center of gravity

– Increase your track width

The MICHELIN® X One® tire does both.

First, the loaded radius of the 445/50R22.5 MICHELIN® X One® XDN®2 tire is 18.7". A 275/80R22.5 MICHELIN® XDN®2 tire (dual equivalent) loaded radius is 18.9". See chart below. For every inch you lower the Center of Gravity, you gain 3 mph additional safety factor with regard to rollover threshold.

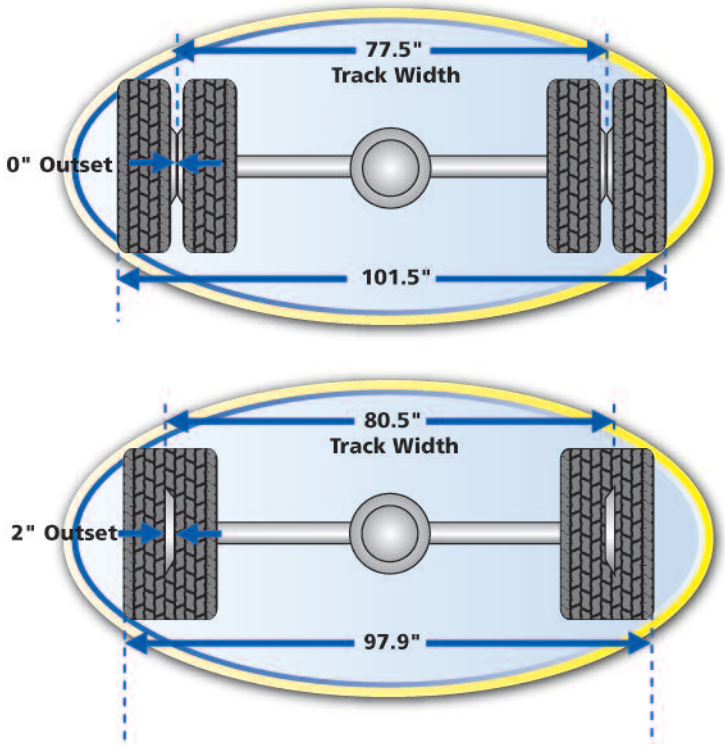
Second, the track width is measured at the center of where the load is distributed on the ground. For dual, this would be measured at the center of the space between the dual. For the MICHELIN® X One® tire, it is simply measured from the center of the left side tire to the center of the right side tire.

As you can see, even though the overall width has reduced, the track width has increased on the MICHELIN® X One® tire.

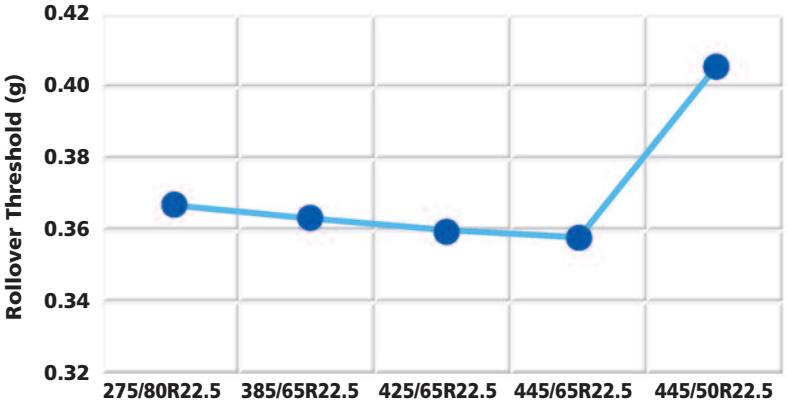
In summary, the MICHELIN® X One® tire improves rollover threshold by increasing cornering stiffness, increasing track width, and reducing the center of gravity.

These improvements have been validated with:

1) Computer simulation where the whole vehicle is characterized mathematically.
2) Track testing at our internal proving grounds.
3) OE vehicle manufacturers in their independent testing, including tilt table testing.



ROLLOVER THRESHOLD WITH TIRE SIZE



Source: Recent evaluations at a MICHELIN facility in South Carolina.

SPECIFICATIONS FOR TREAD DESIGN: MICHELIN® X ONE® XDN®2

Size	Load Range	Catalog Number	Tread Depth	Max. Speed (*)	Loaded Radius		Overall Diameter		Overall Width (‡)		Approved Rim	Revs Per Mile	Max. Load and Pressure Single			
			32nds	mph	in.	mm	in.	mm	in.	mm			lbs.	psi	kg.	kPa
445/50R22.5	L	36587	27	75	18.7	474	40.4	1026	17.1	435	14.00	515	10200	120	4625	830

SPECIFICATIONS FOR TREAD DESIGN: XDN®2

Size	Load Range	Catalog Number	Tread Depth	Max. Speed (*)	Loaded Radius		Overall Diameter		Overall Width (‡)		Approved Rims (Measuring rim listed first.)	Min. Dual Spacing (‡)		Revs Per Mile	Max. Load and Pressure Single				Max. Load and Pressure Dual			
			32nds	mph	in.	mm	in.	mm	in.	mm		in	mm		lbs.	psi	kg.	kPa	lbs.	psi	kg.	kPa
275/80R22.5[1]	G	63465	27	75	18.9	481	40.6	1030	11.0	279	8.25, 7.50	12.2	311	511	6175	110	2800	760	5675	110	2575	760

JACK-KNIFE

When you put the tractor and trailer into an extreme turn or “jack-knife” situation, the trailer is very vulnerable to rollover.

Normally, traction has a positive influence on the handling of the truck. This is no longer true when you put a truck in a jack-knife condition. Whether dual or single configuration, you are forcing the tires to stop rolling and slide sideways. As the photo below clearly demonstrates, the trailer is twisting because the tires are holding their position on the road. This can lead to rollover!

This is especially true for spread axle trailers and high center of gravity loads. Look at the lateral stress placed on the tires from the jack-knife situation.

WARNING

Turning angles should be minimized to avoid rollover threshold whether operating with duals or MICHELIN® X One® tires.

NEVER exceed vehicle limitations because of improved handling.

A tire with a wider footprint is going to provide increased lateral stability when cornering. As a result of this increased lateral stability, the truck will have a tendency to lean less in turns. The increased lateral stability should not equate to increased speed. Always obey posted speed limits on the highways and curves. A good rule of thumb for vehicles with high rollover thresholds (i.e., tankers, concrete mixers) is to take the curves at the posted limit less 10 mph.

RAPID AIR LOSS PROCEDURE

Even though the MICHELIN® X One® tire is an innovative product, it still requires proper air pressure maintenance and visual inspection practices. Tire failure can and will occur.

Below you will find a handy reference of the procedure to bring the vehicle to a safe stop following a rapid air loss event:

Indications:

(Some or all of the following may apply.)

– No change in handling
– Slight lean (depending on wheel position)
– Vibrations
– Audible noise when rapid air loss occurs

Immediate Actions:

– Accelerate enough to maintain lane position. (**DO NOT** apply brakes immediately.)
– Do not apply maximum brake pressure to bring the vehicle to a stop. This stop should be gradual by pumping the brakes.
– Creating assembly lock-up can cause irrepairable damage to tire, wheel, axle components, and vehicle.
– Pull the vehicle to a safe area.
– Do not attempt to limp further down the road.

Secondary Actions:

– Turn on flashers
– Deploy safety triangles
– Inspect vehicle for damage
– Call for assistance

This can be simplified by remembering the following:

DROP
ROLL
and STOP

In other words, the vehicle lean or **DROP** may be the first indication of a rapid air loss. Don't jam on the brakes! Pumping the brakes will allow the damaged wheel end to **ROLL** to a **STOP** without lock-up.

There are many MICHELIN X One tire training videos including rapid air loss handling, and specific application demonstrations. To obtain one of these, contact your local MICHELIN dealer or the MICHELIN sales representative in your area.

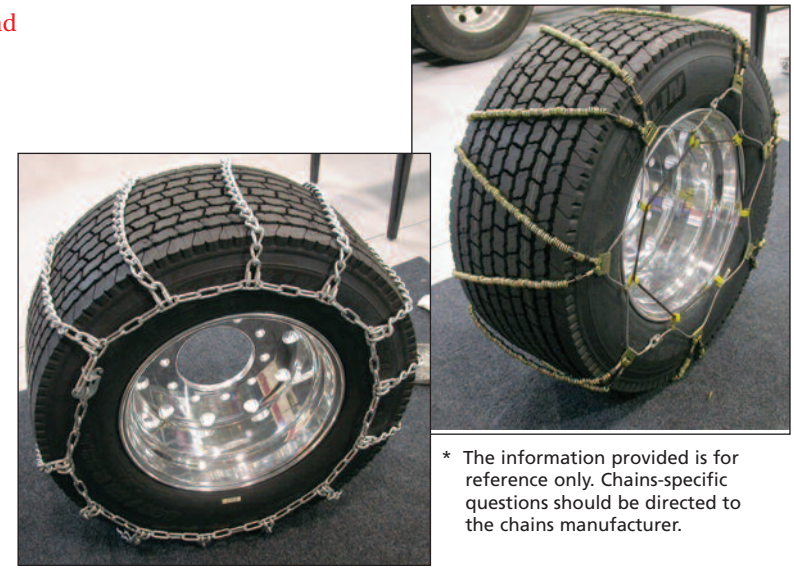
TRACTION

Traction is dependent on the following variables:

– speed
– tread depth
– conditions (dry or wet, depth of water)
– tread design
– tread rubber compound
– road surface (concrete, asphalt)

CHAINS

Depending on the state in which you are traveling, chains may or may not be required. If chains are required, several companies have chains available for the MICHELIN® X One® tire. The thing to remember when purchasing chains for your MICHELIN® X One® tire is the tire size, as the 445/50R22.5 chains don't fit the 455/55R22.5 and vice versa. For more information, consult your local dealer or go to www.tirechains.com*.



* The information provided is for reference only. Chains-specific questions should be directed to the chains manufacturer.

STOPPING DISTANCES

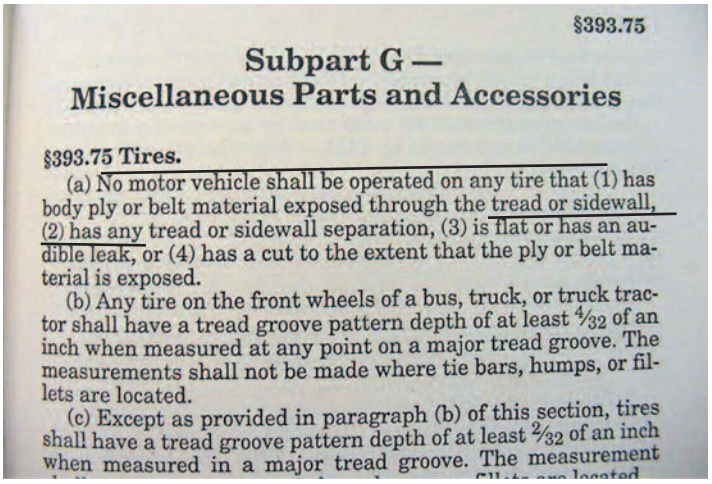
Stopping distance with the MICHELIN® X One® tire is similar to that of a vehicle in dual configuration. A general rule typically mentioned in Commercial Driver's License (CDL) manuals is to allow one vehicle length or one second between your vehicle and the one you are following for every 10 mph of your velocity. For example: if you are driving at 65 mph, allow 6.5 seconds between your vehicle and the one in front of you. A good way to practice this is to mark a spot, such as a bridge, road sign, etc., that the vehicle you're following has just passed and count one-one thousand, two-one thousand, etc., to see how long it takes you to reach the same point. If you count to only four-one thousand, then increase your following distance.

In wet and/or icy conditions, do not assume that because you have better traction you will be able to stop quicker. It is always the best practice to increase following distances and reduce driving speeds when traveling in adverse weather conditions.

LIMPING HOME

Limping on the MICHELIN® X One® tire can cause damage to the wheel and casing. Although the tire is down, it's possible that it is repairable unless it was run-flat. Limping home is never recommended even on dual tires.

DOT (Department of Transportation) Regulation 393.75 states:



§393.75

Subpart G —
Miscellaneous Parts and Accessories

§393.75 Tires.

(a) No motor vehicle shall be operated on any tire that (1) has body ply or belt material exposed through the tread or sidewall, (2) has any tread or sidewall separation, (3) is flat or has an audible leak, or (4) has a cut to the extent that the ply or belt material is exposed.

(b) Any tire on the front wheels of a bus, truck, or truck tractor shall have a tread groove pattern depth of at least 4/32 of an inch when measured at any point on a major tread groove. The measurements shall not be made where tie bars, humps, or fillets are located.

(c) Except as provided in paragraph (b) of this section, tires shall have a tread groove pattern depth of at least 2/32 of an inch when measured in a major tread groove. The measurement

The following provides the top ten reasons not to limp home on any tire.

10 TOP REASONS NOT TO LIMP HOME

10. **Pavement Damage: when the tire is run to destruction, the wheel contact damages the road.**
9. **Wheel Damage: $$$ hundreds of dollars.**
8. **Destroyed Casing: it may have otherwise been repairable. $$$ hundreds of dollars.**
7. **Cargo Damage: load shifts, collisions, roll-overs or fires.**
6. **Collateral Truck Damage: fairings, tanks, hoses, brakes, hoods, mudflaps, etc.**
5. **Wheel and/or Tire Detachment: if the tire/wheel become detached, they become a projectile.**
4. **Adverse Handling Conditions: mishandled, a run-flat could lead to a jack-knife or even a roll-over.**
3. **Direct D.O.T. Violation: fines and downtime.**
2. **Creating assembly lock-up can cause irrepairable damage to tire, wheel, axle components, and vehicle.**
1. **Endangers Other Vehicles and People: heavy duty truck accidents can be fatal.**

STATE AND LOCAL REGULATIONS

Some states have enacted "Load Per Inch Width" regulations for the purpose of governing axle weight on (primarily) the steering axle of commercial vehicles. These regulations provide a carrying capacity of a certain number of pounds per each cross-sectional inch across the tire's width. The determination of the tire's width can vary from state to state, but presumably would be based upon either the tire manufacturer's published technical data for overall width, or the width as marked on the sidewall of the tire (which may require conversion from Metric to English units). It is recommended to contact your state's DOT office to confirm the current "Load Per Inch Width" law.

For example, if a state allows for 550 pounds per inch width, a tire marked 445/50R22.5 could carry up to 9,636 pounds (17.52 x 550) or a total of 19,272 pounds on the drive axle (2 x 9636). Another way to look at it is to take the total weight carried and divide by the stated "Load Per Inch Width" law to determine the appropriate size tire. If a truck needs to carry 16,000 pounds an axle in a state with a 500 pound per inch width limit (16000/500 = 32), you would need a wide single tire that is at least 16 inches wide (32/2). In this case a 445/50R22.5 could legally carry the load (445 mm/25.4 mm per inch = 17.5 inches Metric to English conversion).

The two formulas are:

Load Per Inch Width Law x Tire Section Width x Number of Tires = Gross Axle Weight Limit

Gross Axle Weight/Inch Width Law/Number Of Tires = Minimum Tire Section Width Needed

State laws and regulations frequently can and do change, so it is recommended that you consult your local State or Province DOT and where you will be traveling to be sure there are no restrictions on the use of the MICHELIN® X One® tire for your particular operation, equipment, and weight.

Heat study

BRAKE HEAT OVERVIEW

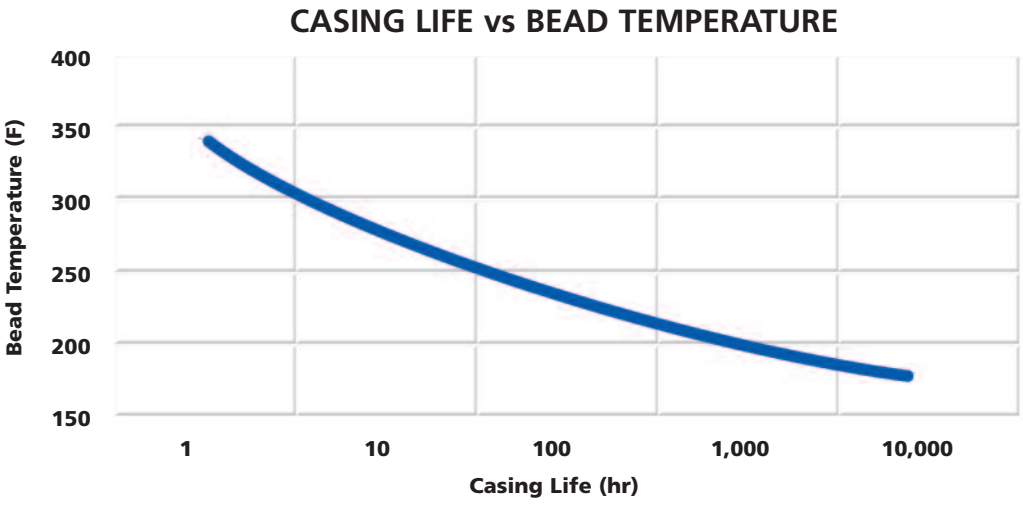
Truck brake often reach very high temperatures. Brake drums can reach temperatures of 600° F or more and are in very close proximity to the wheels. This heat can be easily transferred to the wheels and tires. Brake drum heat is transferred to the wheel primarily through radiation and convection. The hot brake drum radiates heat in all directions to the wheel. In addition, the drum heats the air between the drum and the wheel. The heated air rises and transfers additional heat energy to the wheel through convection. Much of the heat is transferred to the wheel in the bead mounting area due to its close proximity to the brake drum. The wheel then directly conducts heat to the tire bead resulting in elevated temperatures in the tire bead area.

Duals – Close to Brake Drum

Excessive bead heat can affect tire life in many truck tire applications. Vehicles in urban and refuse service are most commonly associated with bead heat issues, but any application that experiences hard braking can be affected.

Results of bead heat:

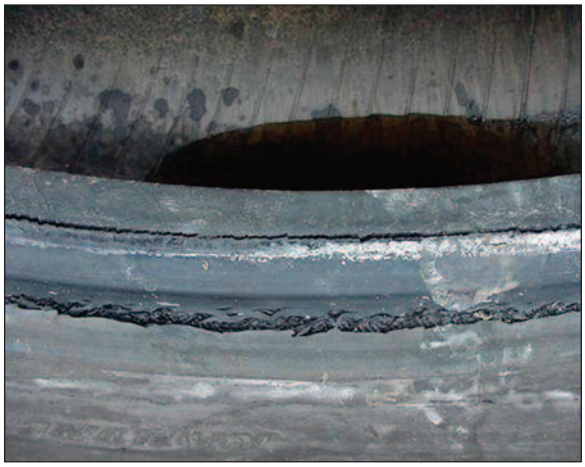
1. **Immediate Failure:** In some cases, after periods of hard braking where brake drums reach very high temperatures (in excess of 600° F), immediate failure can occur. This normally occurs when a truck is brought to a stop for a period of time with very high brake temperatures. Often this occurs when an over-the-road truck stops at a truck stop at the bottom of a long descent. As the heat rises from the brake drum, there is excessive heat buildup in the portion of the tire bead directly above the brake drum (inner bead of inside dual). The high temperature can cause a breakdown of the rubber products in the bead area and allow the steel body cables to unwrap from the bead. This process results in a tire rapid air loss. This phenomenon is also common in urban and refuse fleets when the driver stops for a break after a period of hard braking.
2. **Premature aging of the carcass:** **Heat is a tire's worst enemy!** A tire subjected to high heat conditions over an extended period of time will experience accelerated aging of the rubber products. The accelerated aging may result in a blowout during operation, or it may render the casing unsuitable for retread. The graph below demonstrates how operating with bead temperatures in excess of 200°F will significantly reduce your casing life.



Bead damage as a result of brake heat is recognizable in 3 stages of severity. In the first stage, the bead starts to turn inward. This can be visibly identified on the tire when it is dismounted. A straight edge placed across the beads from one bead to the other no longer rests on the bead point, but now rests closer to the bead bearing area.

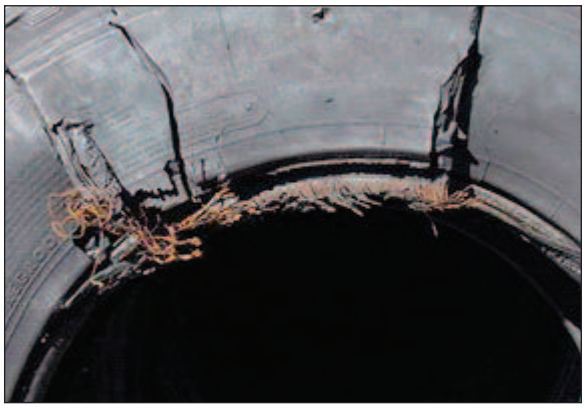
1st Stage – Turning of the Bead

The second stage occurs when the rubber in the bead area starts to split or crack indicating that the steel casing plies are starting to unwrap.



2nd Stage – Bead Splitting from Heat

The third stage is when the casing ply fully unwraps from the bead. In extreme cases, the casing ply unwraps from the bead all the way around the tire. At this point the tire completely separates from the bead wire. The bead wire can entangle itself around the axle if this type of separation occurs.



3rd Stage – Partial Unwrapping of the Casing Ply

3rd Stage – Complete Unwrapping of the Casing Ply

BRAKE HEAT EVALUATION: MICHELIN® X ONE® TIRES VS DUALS

MICHELIN® X One® tire fitments have greater clearance between the brake drum and the bead of the tire compared to a dual assembly. In addition, due to the 2" outset of the wheel for the MICHELIN® X One® tires, more brake drum is exposed, which provides greater air flow around the drum. These characteristics reduce the heat transfer from the brakes to the tire and allow the brakes to run cooler.

Exposed Brake Drum

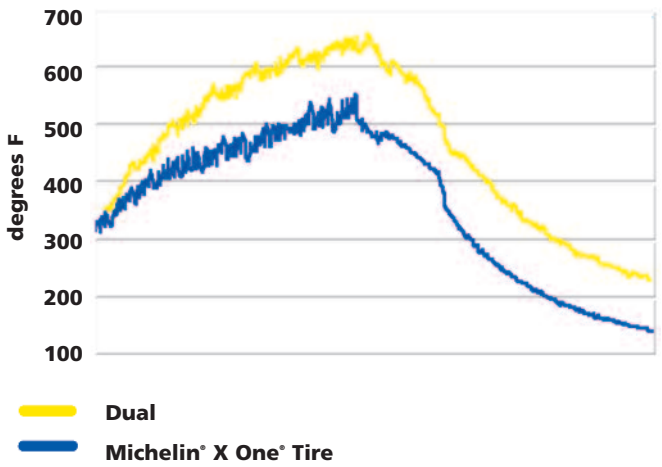
This effect was demonstrated on a closed course at the Laurens Proving Grounds, Michelin's 3,000 acre test facility.

The Test

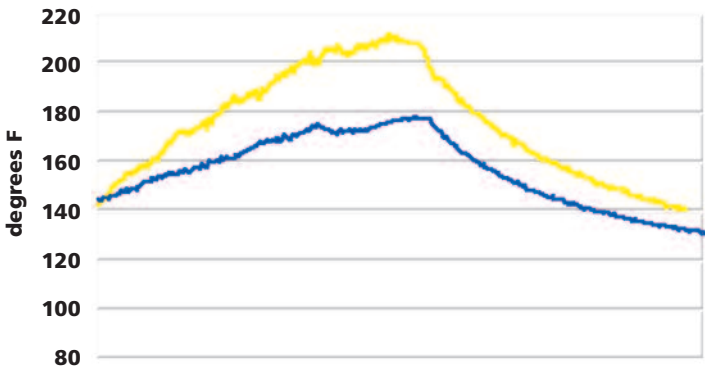
A 4x2 straight truck outfitted with a temperature logging device was loaded to maximum legal limits and operated on a closed course with almost continuous starting and stopping cycles. The truck was brought up to 30 mph and then stopped repeatedly for 45 minutes. The temperature logging device recorded brake drum and wheel temperatures (in the bead area) every 10 seconds. The test was run on both MICHELIN® X One® tires and duals at similar track temperatures and weather conditions.

After 45 minutes, when the brakes were at their peak temperature, the temperatures from the data loggers were compared. The brake drums fitted with MICHELIN® X One® tires were over 100°F cooler and the wheels were over 30°F cooler in the bead area than when equipped with Duals!

BRAKE TEMPERATURE MICHELIN® X ONE® TIRES vs DUALS



WHEEL TEMPERATURE MICHELIN® X ONE® TIRES vs DUALS

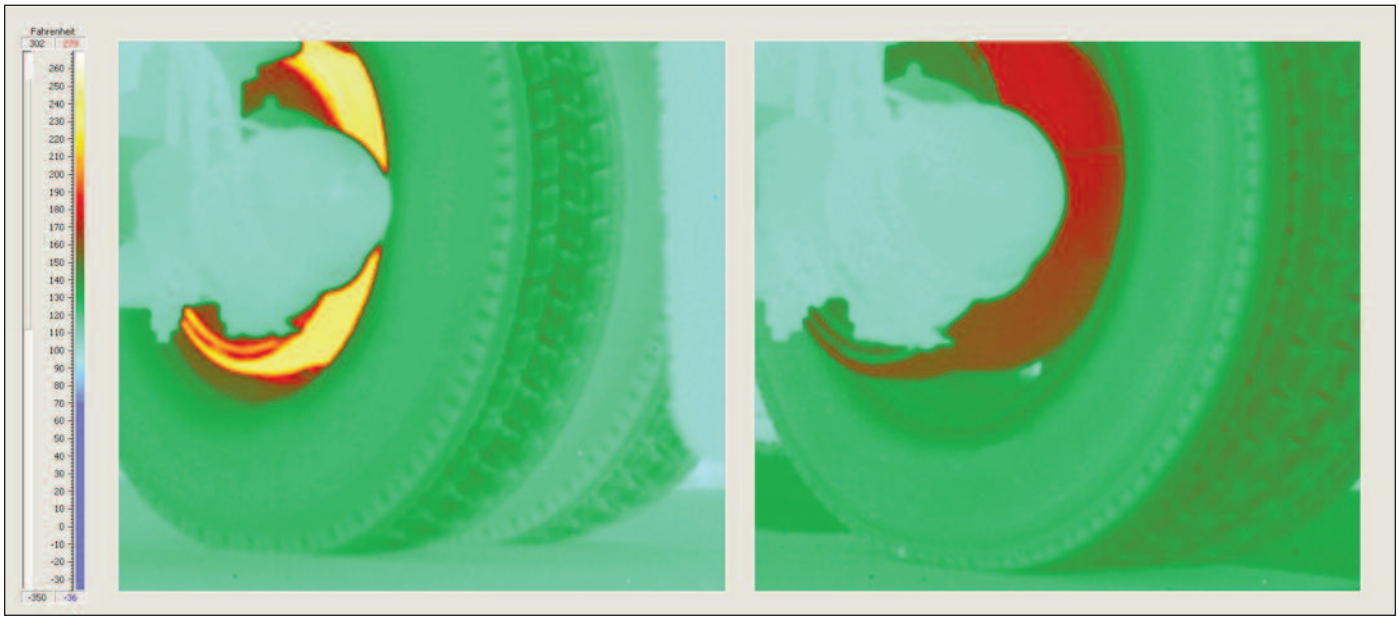


Source: Recent evaluations at a MICHELIN facility in South Carolina.

Thermal Imaging

The thermal image photos were captured after the repeated stopping test followed by 30 minutes of driving without braking. A brake drum temperature advantage for the MICHELIN® X One® tire of 90°F was still apparent even after the cool down period.

It is safe to say that for any given truck, brake temperatures on MICHELIN® X One® tire equipped vehicles will be significantly cooler than brakes on trucks running conventional duals. This effect will be most pronounced during periods of heavy braking but will persist for some time after braking has ended.



Dual **MICHELIN® X One® Tire**

Source: Recent evaluations at a MICHELIN facility in South Carolina.

Appendix

ISO LOAD INDEX AND SPEED SYMBOL 70

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ISO LOAD INDEX AND SPEED SYMBOL

LOAD INDEX

The ISO* LOAD INDEX is a numerical code associated with the maximum load a tire can carry at the speed indicated by its SPEED SYMBOL under service conditions specified by the tire manufacturer. (1 kg = 2,205 lbs.)

Load Index	kg	lbs
155	3,875	8,540
156	4,000	8,820
157	4,125	9,090
158	4,250	9,370
159	4,375	9,650
160	4,500	9,920
161	4,625	10,200
162	4,750	10,500
163	4,875	10,700
164	5,000	11,000
165	5,150	11,400
166	5,300	11,700
167	5,450	12,000
168	5,600	12,300
169	5,800	12,800

SPEED SYMBOL

The ISO* SPEED SYMBOL indicates the speed at which the tire can carry a load corresponding to its Load Index under service conditions specified by the tire manufacturer.

Speed Symbol	Speed	
	kph	mph
J	100	62
K	110	68
L	120	75
M	130	81
N	140	87

* International Standards Organization
Exceeding the lawful speed limit is neither recommended nor endorsed.

DEFINITIONS

Standard and Low Profile radial truck tire sizes can be more easily understood by breaking down the formula into the three components: the section width in inches or millimeters, aspect ratio, and rim/wheel diameter.

1. Tire Size:

Standard Size example: **11R22.5**

- 11 inch nominal section width, with a height between 90 and 100% of the section width
- R = radial
- 22.5 wheel diameter

Low Profile example: **445/50R22.5**

- 445 millimeter nominal section width
- 50 is the aspect ratio expressed as a height to width percentage
- R = radial
- 22.5 wheel diameter

2. Aspect Ratio: A nominal number, which represents the section height, divided by the section width expressed as a percentage.

Example 445/50R22.5
Aspect Ratio = 50

3. Rims: The approved/preferred rims are designated for each size tire. MICHELIN® X One® tires should only be mounted on the rims shown in the application specific data book.

4. Overall Width: The maximum width (cross section) of the unloaded tires including protruding side ribs and decorations as measured on the preferred rim. Overall width will change 0.1 inch (2.5 mm) for each 1/4 inch change in rim width.

5. Overall Diameter: The diameter of the unloaded new tire (measured from opposite outer tread surfaces).

6. Free Radius: One-half the overall diameter of the unloaded new tire.

7. Nominal Wheel Diameter: Diameter of rim seat supporting the tire bead given in nearest whole numbers, e.g. 22.5".

8. Section Height: The distance from rim seat to outer tread surface of unloaded tire.

9. Loaded Radius: The distance from the wheel axle centerline to the supporting surface under a tire properly inflated for its load according to the load and inflation tables.

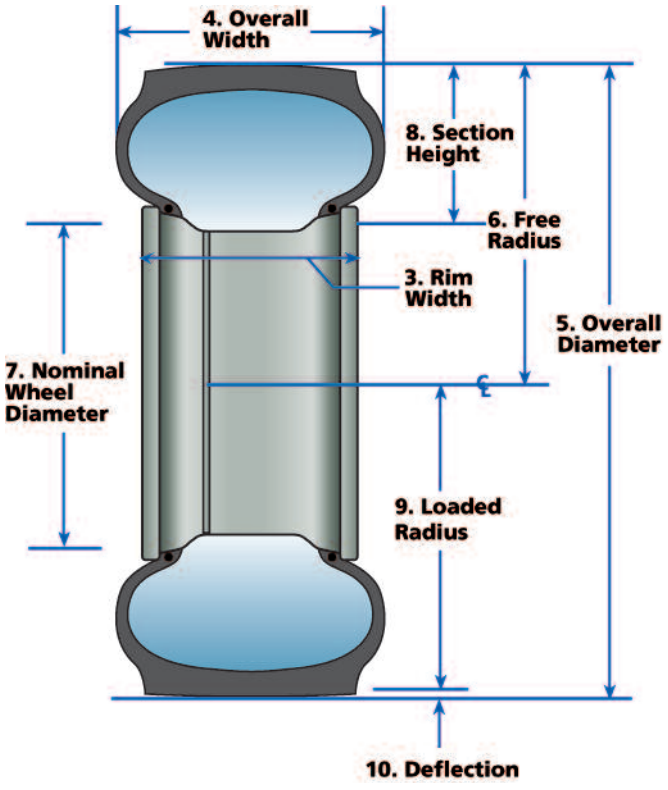
10. Tire Deflection: Free radius minus the loaded radius.

11. Tire Revolutions Per Mile: Revolutions per mile for a tire size and tread is defined as the number of revolutions that the new tire will make in one mile. Data is normally presented for the loaded tire at its rated load and inflation in the drive position.
Tire revolutions per mile (Tire Revs./Mile) can be determined by measuring using SAE J1025 or estimated by calculating using a mathematical equation.

Michelin Equation:

Tire Revs./Mile = 20,168/(O.D. - .8d)
O.D. = Overall Diameter
d = Correction for deflection
d = (O.D./2) – SLR
SLR = Static Loaded Radius (MICHELIN Truck Tire Service Manual - MWL40732)

At Michelin, the tire revolutions per mile are officially determined using the Society of Automotive Engineers (SAE) Recommended Practice. The test tires are placed as singles on the drive axle of the test vehicle and set to the corresponding pressure. The vehicle is then driven over a straight 2-mile section at 45 mph while the number of revolutions are counted. (Since speed minimally affects the results for radial tires, other speeds are allowed.) Averaging 4 runs that are within 1% of each other then derives the tire's revolutions per mile measurement.



Afterward, the results are double-checked using shorter distances that are more easily obtained. In addition to these, the test tire is compared to a known baseline tire on a road wheel. This latter method is very accurate and very repeatable when using a similar baseline tire with a known tire revolutions per mile (Tire Revs./Mile).

The Society of Automotive Engineers (SAE) procedure recognizes that within the test method itself, there will be some variation. In fact there are other factors that cause variation on the tire revolutions per mile's among similar tires. Be aware that they will have the same revolution per mile. The SAE procedure determines the tire revolutions per mile to within ± 1.5%.

Some factors, which cause variation among tires, are:

Load and Pressure – A difference in load/pressure could alter the tire revolutions per mile measurement by as much as 1.5%. If pressure is constant, going from an empty vehicle to a fully loaded vehicle can change revolution per mile by 1 to 1.5%.

Treadwear – The tire revolutions per mile vary from a new tire to a fully worn tire. This can affect tire revolutions per mile by as much as 3% from the rated tire revolutions per mile.

Tread Geometry – The height and stiffness of the blocks and the shape of the tread pattern can affect tire revolutions per mile.

Torque – The presence of driving and braking torque can affect the tire revolutions per mile.

Type and Condition of Pavement – Asphalt vs. concrete, wet vs. dry can create differences in tire revolutions per mile.

CALCULATED TIRE REVOLUTIONS PER MILE

Example: 445/50R22.5 MICHELIN® X One® XDN®2 (new tire)

O.D. = 40.4
SLR = 18.7
d = (40.4/2) - 18.7
d = (20.2 - 18.7) = 1.5

Tire Revs./Mile = 20,168/(40.4 - (.8 x 1.5))
= 20,168/(40.4 - 1.2)
= 20,168/39.2
Tire Revs./Mile = 514.489 (Calculated) vs. Data Book (Measured) tire revolutions per mile of 515.

All the information required to determine the proper tire size is contained in the application specific data books.

To select the proper tire size for a vehicle, it is necessary to know the maximum axle loads that the tires will carry and the maximum continuous speed at which they will operate. The maximum load that a tire can carry is different if it is mounted in single configuration rather than in dual. The allowable axle loads and the required inflation pressures to carry these loads are shown in the charts for both single and dual mountings in the current MICHELIN Truck Tire Data Book (MWL40731). The maximum allowable continuous speed is also indicated.

SPECIAL TOOLS / MOUNTING TOOLS

Special tools are available to aid in the mounting and demounting of the MICHELIN® X One® tire on/off the wheel and the MICHELIN® X One® assembly on/off the vehicle. Due to the size of the tire and wheel these tools will assist the tire technician in providing both safe and easy methods of removal and installation.

When removing any tire from a wheel you should use an Impact Bead Breaker (Slide Hammer) to prevent bead damage. This is also a safer way to dislodge the tire beads from the wheel.

Impact Bead Breaker (Slide Hammer)

WARNING

DO NOT USE HAMMERS of any type. Striking a wheel/rim assembly with a hammer can damage both the tire and the wheel and is a direct OSHA violation.

AFTER YOU MOUNT THE MICHELIN® X ONE® TIRE ON THE WHEEL, YOU MUST CAGE IT!

An extra wide safety cage is available for safe inflation of the tire. In most cases, a standard cage can accommodate the MICHELIN® X One® assembly.

DOT (Department of Transportation) requires that all truck tires are to be inflated in an inflation cage.

WARNING! Tire changing can be dangerous and should be done only by trained personnel using proper tools and equipment as directed by Federal OSHA Standard No. 29 CFR Part 1910.177. Tires may explode during inflation causing injury to operator or bystander. Wear safety goggles. Keep all parts of body outside cage. Use extension hose, clip on chuck, and remote valve.

Consult the MICHELIN Truck Tire Data Book (MWL40732) for proper inflation.

Safety Cage with MICHELIN X One Tire

TOOLS FOR HANDLING THE MICHELIN® X ONE® TIRE ASSEMBLY:

Tire and wheel dollies are available from commercial tire supply companies to make the mounting and removing of the assemblies on/off of the vehicle easier. There are various types to choose.

A tire dolly may provide the lifting assistance to mount or remove the MICHELIN® X One® tire assembly, which may help to avoid possible injury.

Tire Dolly

Some people have difficulty standing on the tire using conventional mounting techniques, and good devices to help "hold" the bead in place without damaging the wheel are coated bead keepers, shown here.

Bead Keepers

Special Cart for Removing Stuck Wheels

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